What's New with La Niña and the Outlook for May, June and July Including A Look Forward to the Upcoming Severe Weather Season

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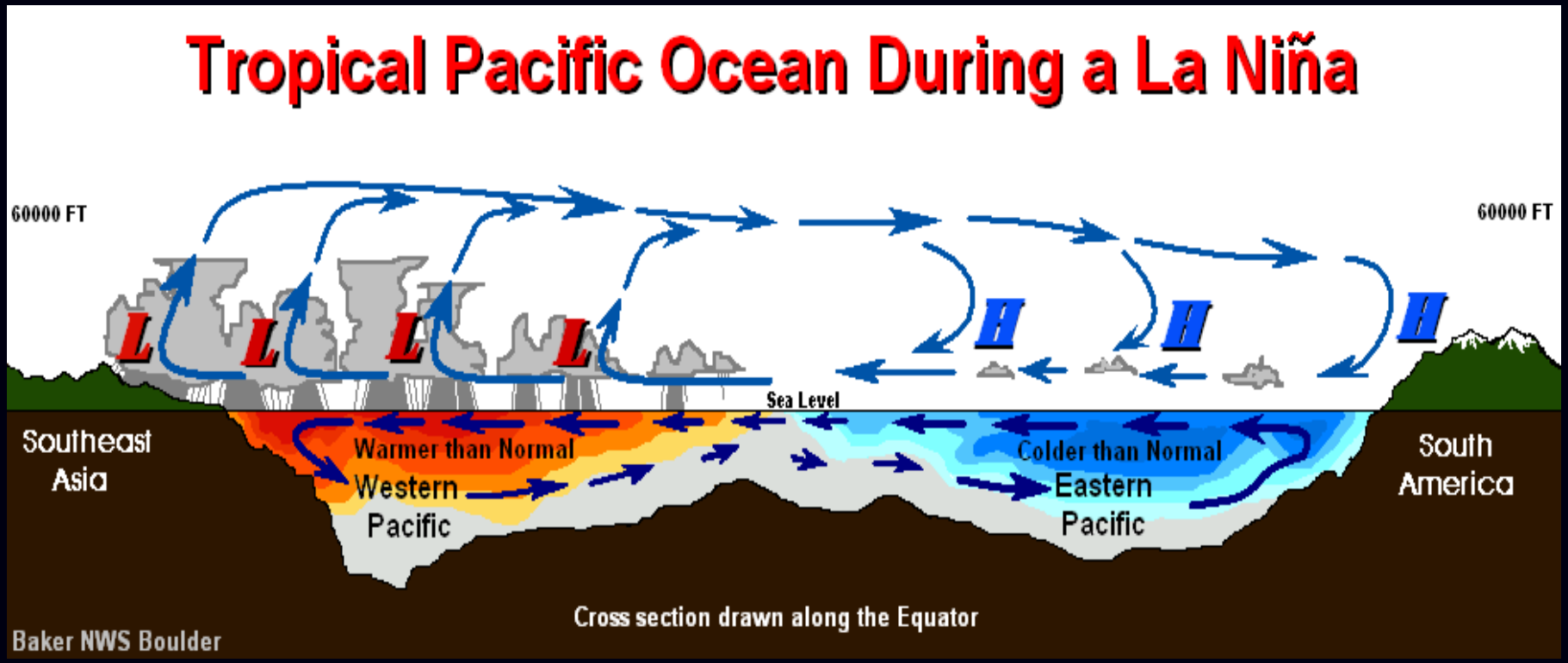
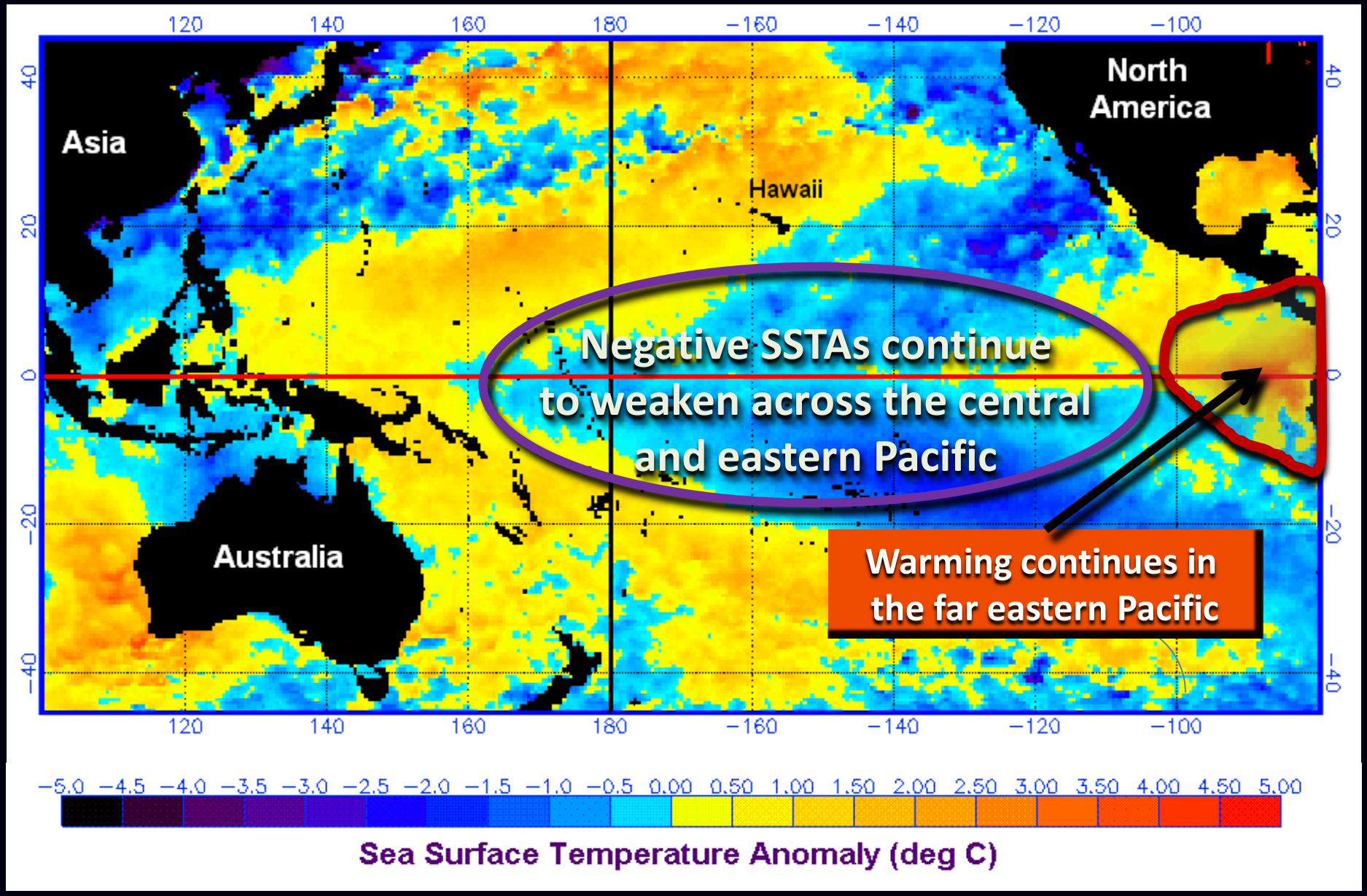
Contents

- The latest update on La Niña and how it continues to compare with other strong La Ninas of the past 40 years.
- A review of precipitation, snow pack, water snow equivalence, and drought conditions across Colorado during the past 30 and 90 days.
- The possible impact of a weakening La Niña on weather across Colorado during May, June and July. This includes a look at the type of severe weather that is often observed along the Colorado Front Range at the conclusion of moderate to strong La Ninas. Attention will be on hail and lightning.
- The latest wildland fire conditions currently observed and expected across Colorado during the coming months provided by Predictive Services in Boise, Idaho.
- Temperature and precipitation composites and outlooks for May-June-July 2011 provided by NOAA's Climate Prediction Center.

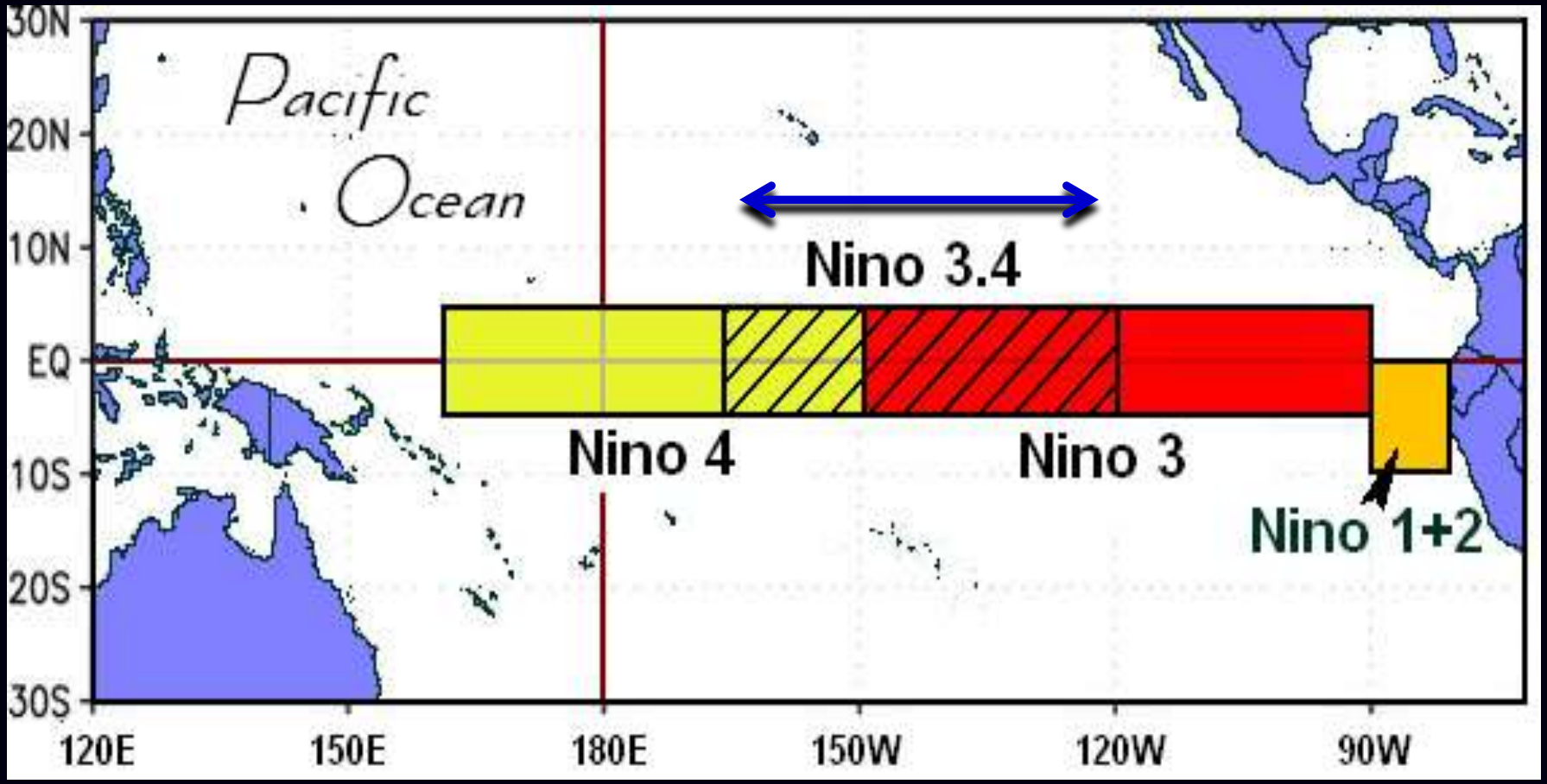
La Niña Continues to Weaken in the Pacific



NOAA/NESDIS SST Anomalies for the Pacific Ocean (degree C) for April 25, 2011



Niño Regions in the Tropical Pacific Ocean



Nino 3.4 – The principal region in the eastern tropical Pacific used by the Climate Prediction Center (CPC) for monitoring, assessing and predicting ENSO.

Oceanic Niño Index (ONI)

- The **ONI** is based on sea surface temperature (SST) departures from average in the Niño 3.4 region of the Pacific and is a principal measure for monitoring, assessing, and predicting ENSO.

- Defined as the three-month running-mean SST departures in the Niño 3.4 region

- Used to place current events into a historical perspective

- NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a ***positive*** ONI greater than or equal to +0.5 C.

La Niña: characterized by a ***negative*** ONI less than or equal to −0.5 C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

Oceanic Niño Index - ONI

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1.0	-0.8	-0.6	-0.5	-0.4	-0.4	-0.4	-0.5	-0.6	-0.7
2001	-0.6	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.2	0.1	0	-0.1	-0.1
2002	-0.1	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.4
2003	1.2	0.9	0.5	0.1	-0.1	0.1	0.4	0.5	0.6	0.5	0.6	0.4
2004	0.4	0.3	0.2	0.2	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8
2005	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.1
2007	0.8	0.4	0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.7	-1.0	-1.1	-1.3
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0	0	0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6	-1.0	-1.3	-1.4	-1.4	-1.4
2011	-1.3	-1.2										

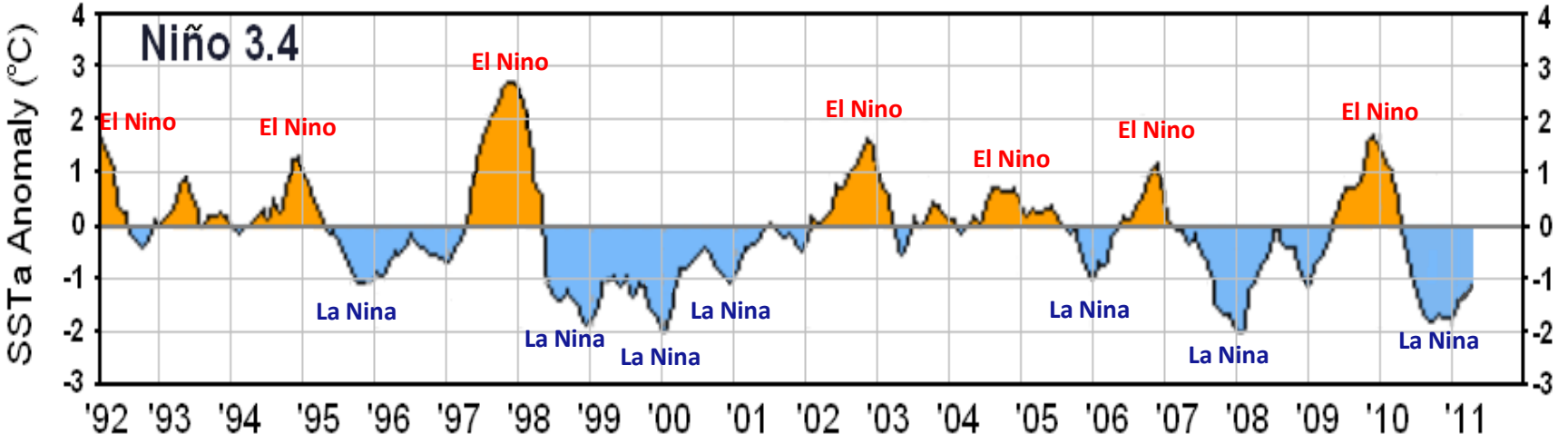
Warm Episodes - El Niños: ONI +0.5 and above (red numbers)

Cold Episodes - La Niñas: ONI of -0.5 and below (blue numbers)

Neutral or non-ENSO Episodes: ONI above -0.5 and below 0.5 (black numbers)

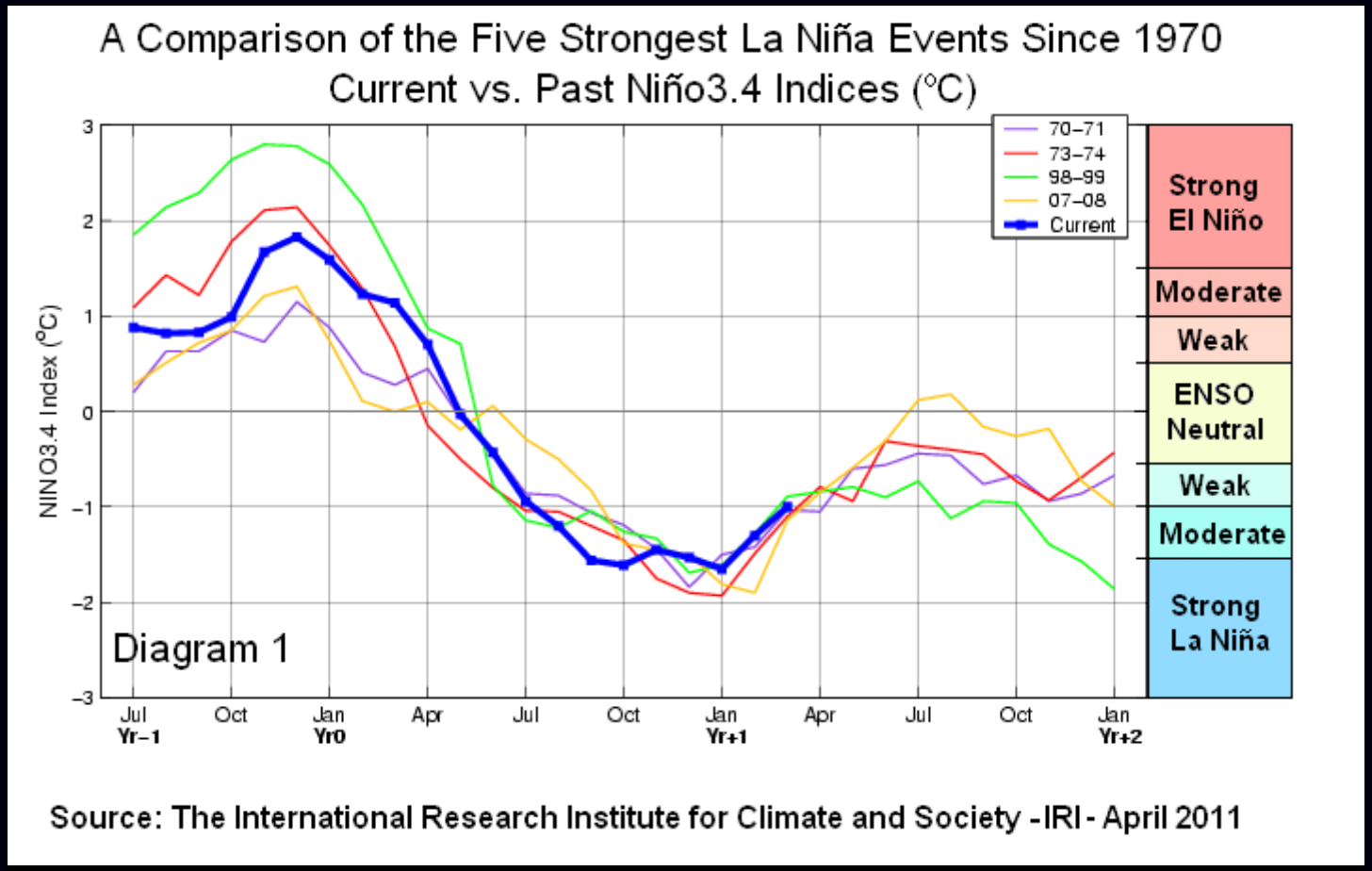
The latest ONI has changed little since its lowest value in January. An ONI of -1.2 means that La Niña was still of a moderate strength through March 2011.

NOAA/CPC Apr 21 2011



Area-Averaged Sea Surface Temperature Anomalies in Degrees C for Pacific Region Nino 3.4 from February 1992 through March 2011

A total of seven El Niños and seven La Niñas of varying strengths have occurred since the winter season of 1991-1992. Noteworthy ENSO events include the strong El Niño during the winter seasons of 1997-1998 and 2009-2010, and the strong La Niña during the winter seasons 1999-2000 and 2010-2011. The unusually strong La Niña during the winter season of 1999-2000 was part of an abnormally long period of La Niña conditions that lasted from the fall of 1998 through the spring of 2001.

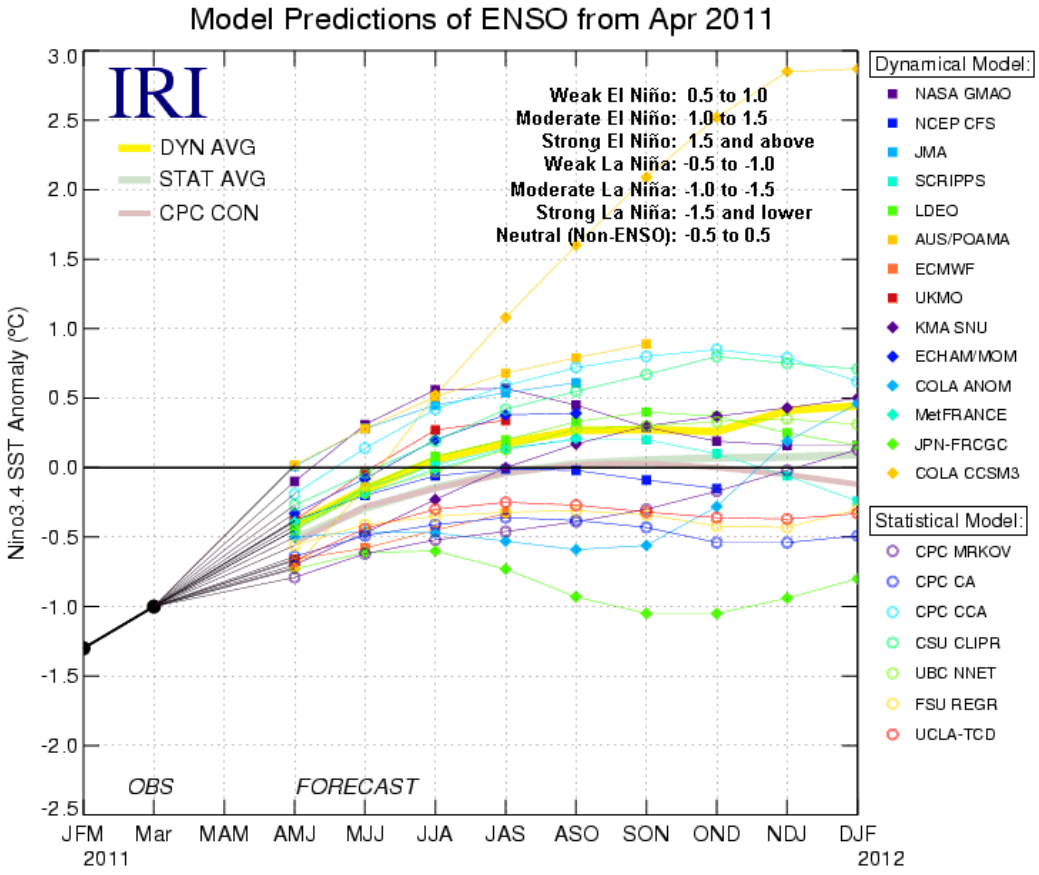


Source: The International Research Institute for Climate and Society - IRI - April 2011

Above is a comparison of NINO 3.4 Indices for the current strong La Niña and the last four La Niña episodes of similar strength since 1970. Notice how closely these indices track together, particularly during the winter and spring months.

Should the current La Niña continue to behave similarly to the last four strong cold phase ENSO events, presumably we could see a return of weak La Niña conditions by this fall.

Pacific Region Niño 3.4 ENSO Outlook



Average Seasonal Sea Surface Temperature Anomalies Forecasted by All Models for AMJ 2011 Through DJF 2011-2012

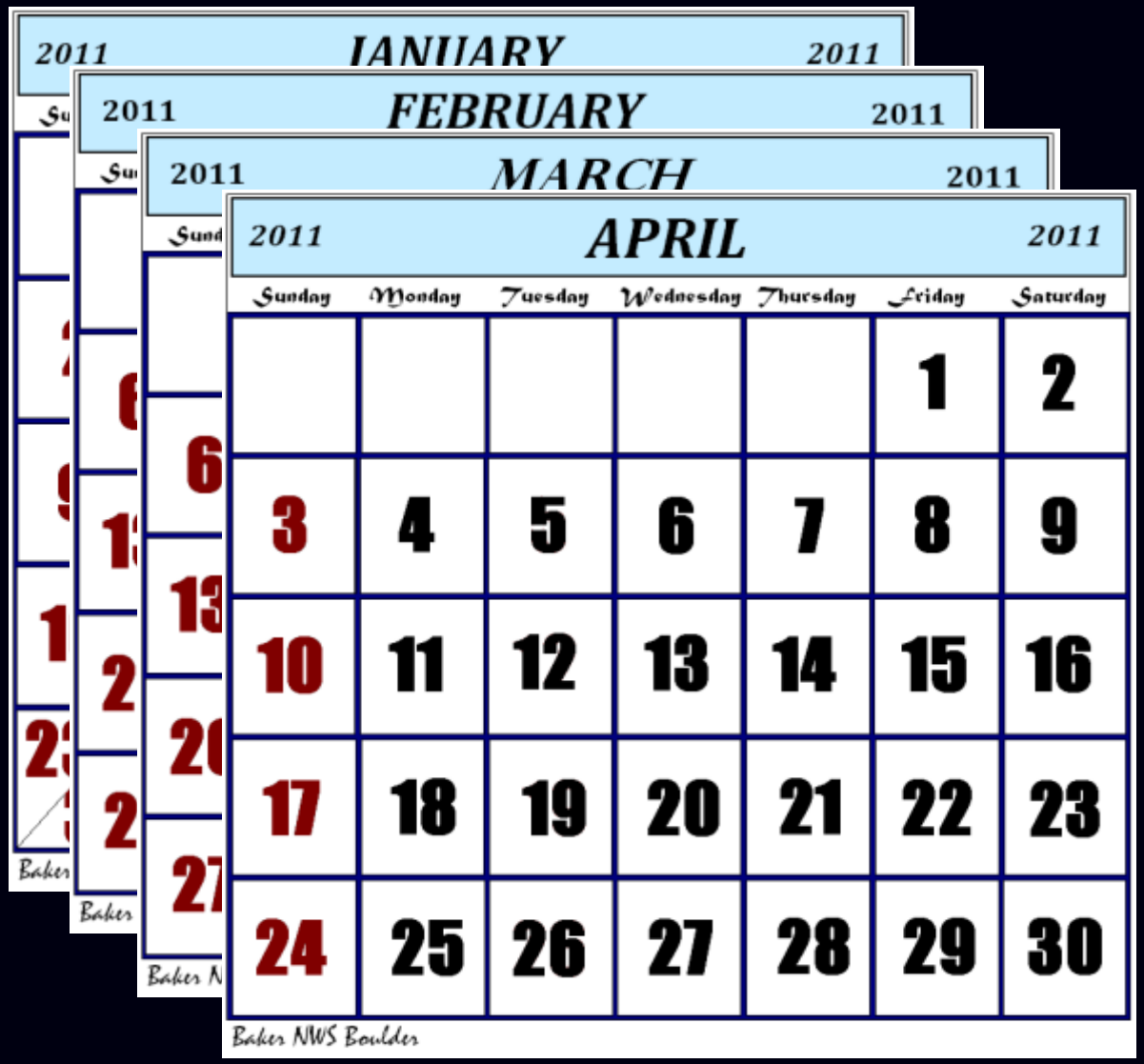
AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ	DJF
-0.5	-0.2	-0.0	0.1	0.1	0.1	0.1	0.2	0.2

- **All 23 dynamical and statistical ENSO models continue to indicate further weakening of the negative SST anomalies in the eastern tropical Pacific region Niño 3.4 through the remainder of this spring. By early this summer a large majority of the models forecast that ENSO neutral (+0.5 C to -0.5 C) conditions will exist.**

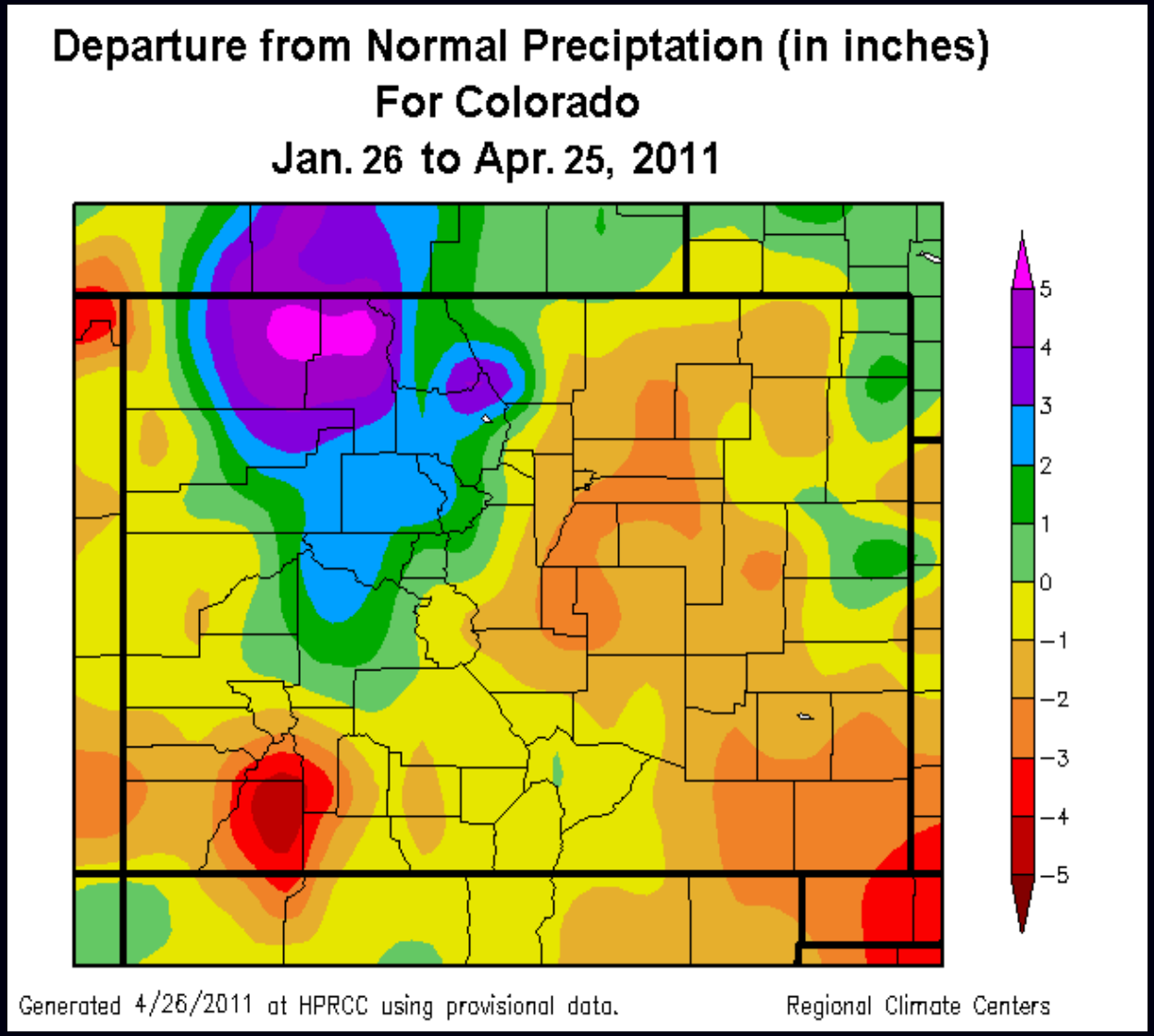
- **Model consensus also indicate ENSO neutral conditions in the eastern tropical Pacific through the summer and into next autumn; although a small number of these models are split between weak La Niña and weak El Niño conditions by this fall.**

Source: International Research Institute for Climate and Society (IRI) – Updated 4/19/11


Inches of depth
> 150
100 to 150
75 to 100
50 to 75
40 to 50
30 to 40
20 to 30
16 to 20
12 to 16
8 to 12
4 to 8
2 to 4
Not Estimated
FCL
GXY
DEN
LIC
GJT
MTJ
GUC
PUB
LAA
LHX
ALS
DRO
TAD
Colorado -
Last 90 Days in Review
Modeled Snow Depth Across Colorado for April 17, 2011 from NOHRSC

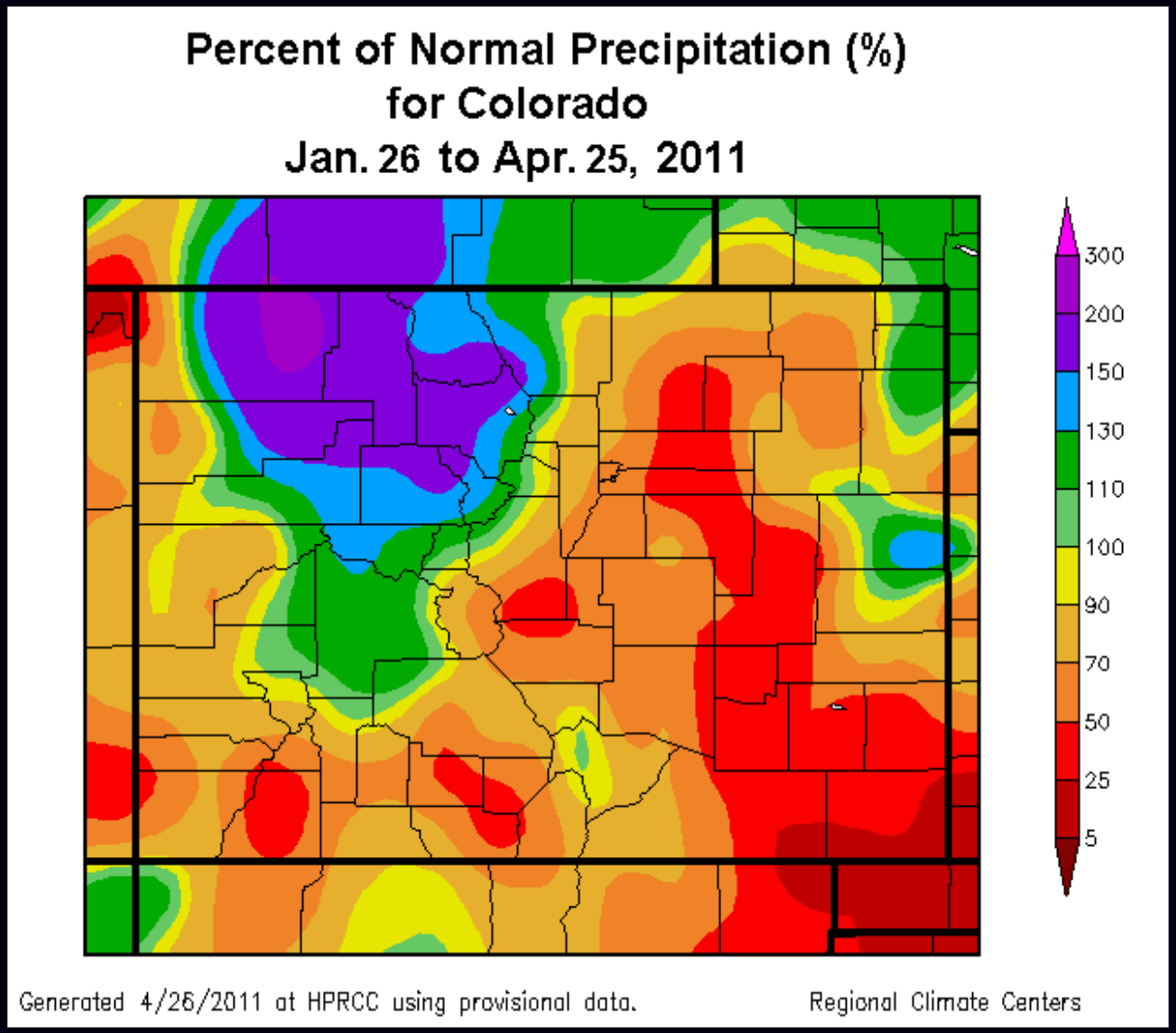


Temperature, Precipitation, Snow Pack, Snow-Water Equivalence and Drought Conditions Across Colorado for the Past 90 Days



Precipitation, mainly in the form of snow, continued to fall on northwest Colorado during this 3-month period. The Yampa River Basin, specifically Moffat and Routt counties, saw water equivalent precipitation departures over five inches above normal! The Front Range Mountains in northern Colorado also recorded departures well above normal.

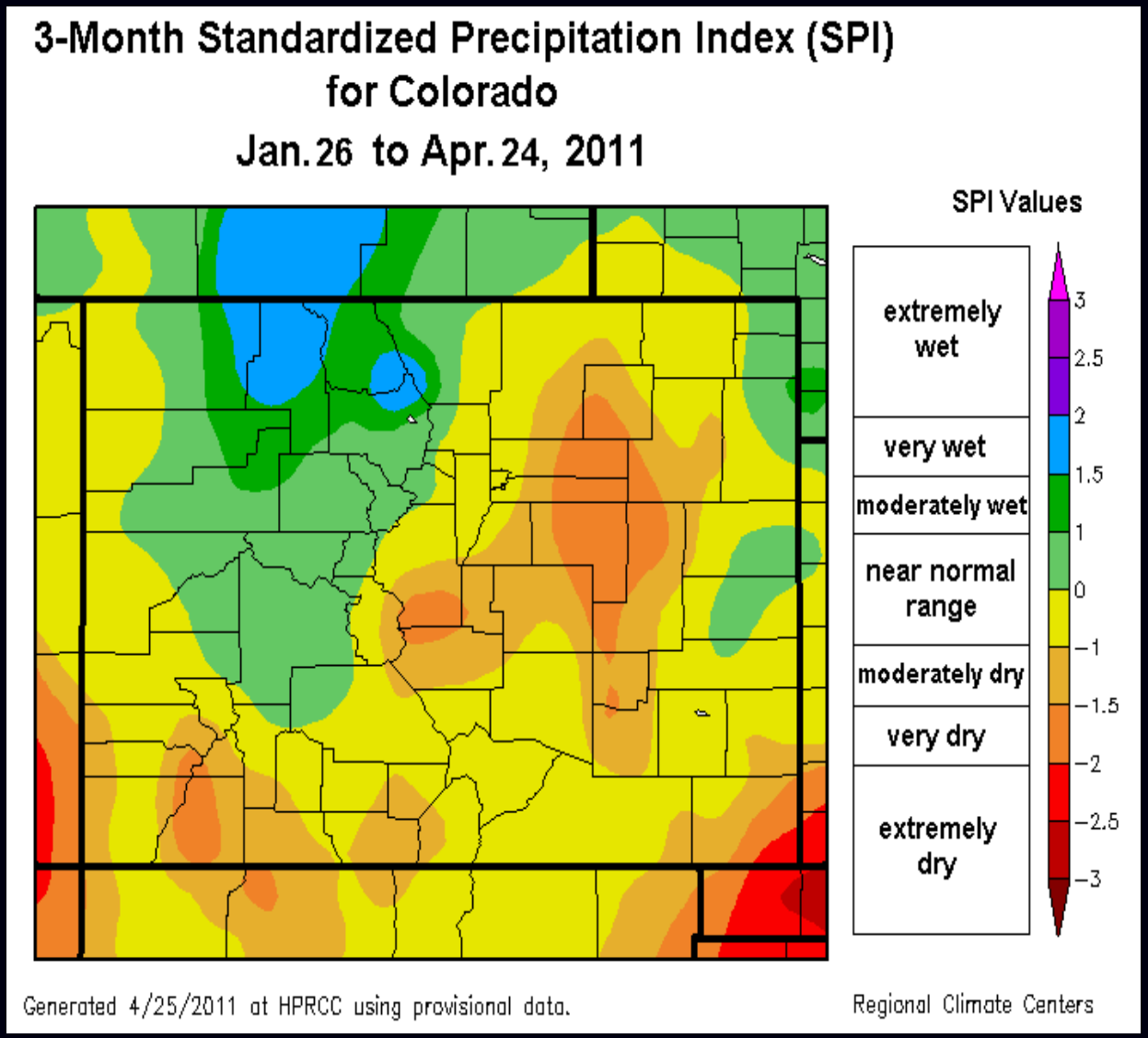
Southern and eastern sections of the state continued to record average to below average precipitation, with significant precipitation deficits noted on the southern slopes of the San Juan Mountains and the far southeastern plains.



Precipitation for the 90 day period ending April 25th was as much as 300 percent above normal for parts of north-west Colorado, as indicated by the purple shading.

Precipitation in the Elk, West Elk, and Ten Mile Mountain ranges, the lower valleys around Aspen, Vail and Gunnison, and the far northeast and east central plains of Colorado was also well above normal.

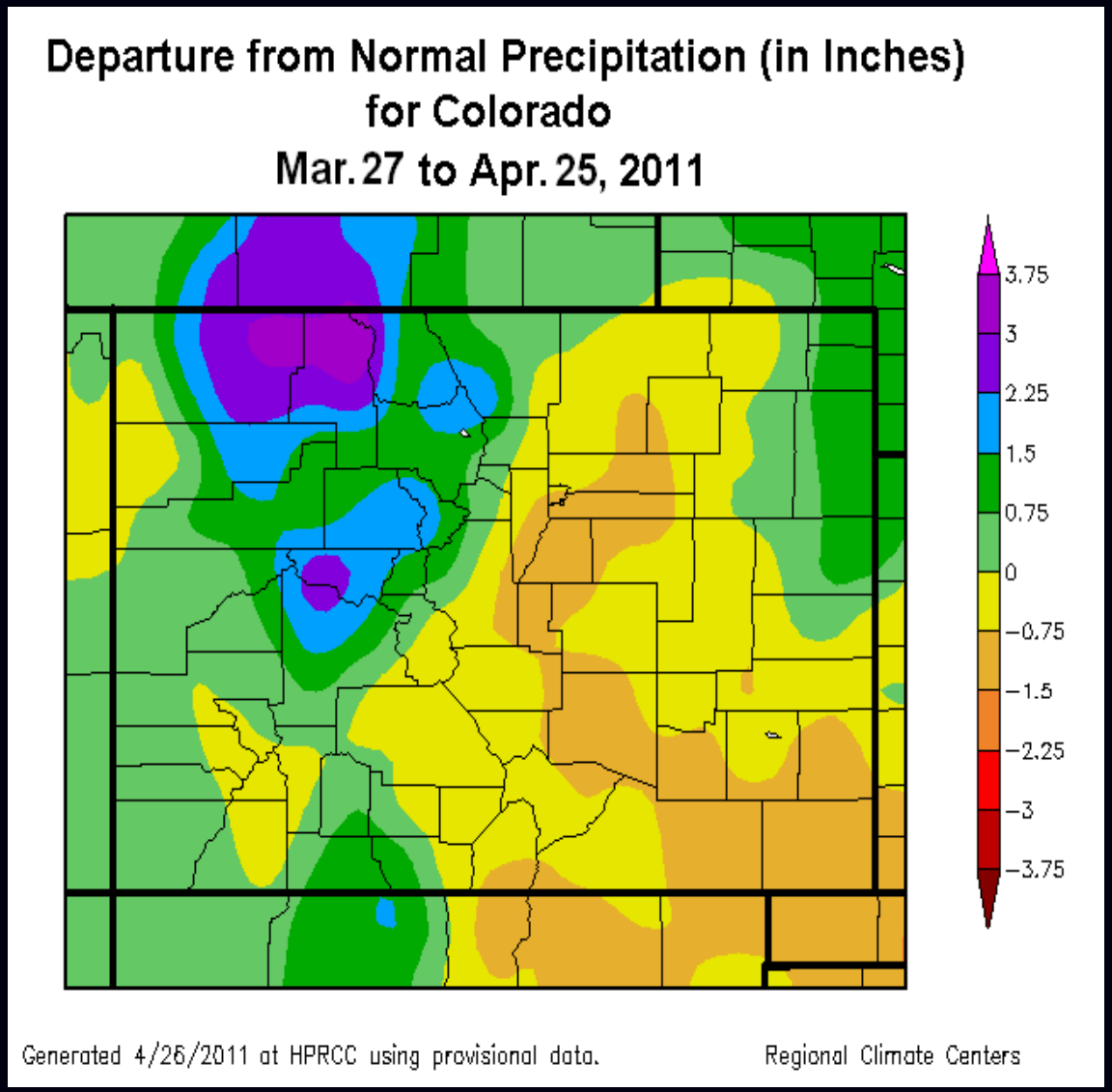
Conversely, the southeast plains, the Upper Rio Grande Basin and the southwest corner continued to record much below normal precipitation-- a distribution pattern commonly observed during La Niña winters.



During the 90-day period ending April 24, 2011, the SPI indicates very wet conditions across northwest Colorado and moderately wet conditions in west central and extreme northeast Colorado. Conditions across the remainder of the state ranged from near normal along the Front Range to extremely dry on the far southeast plains.

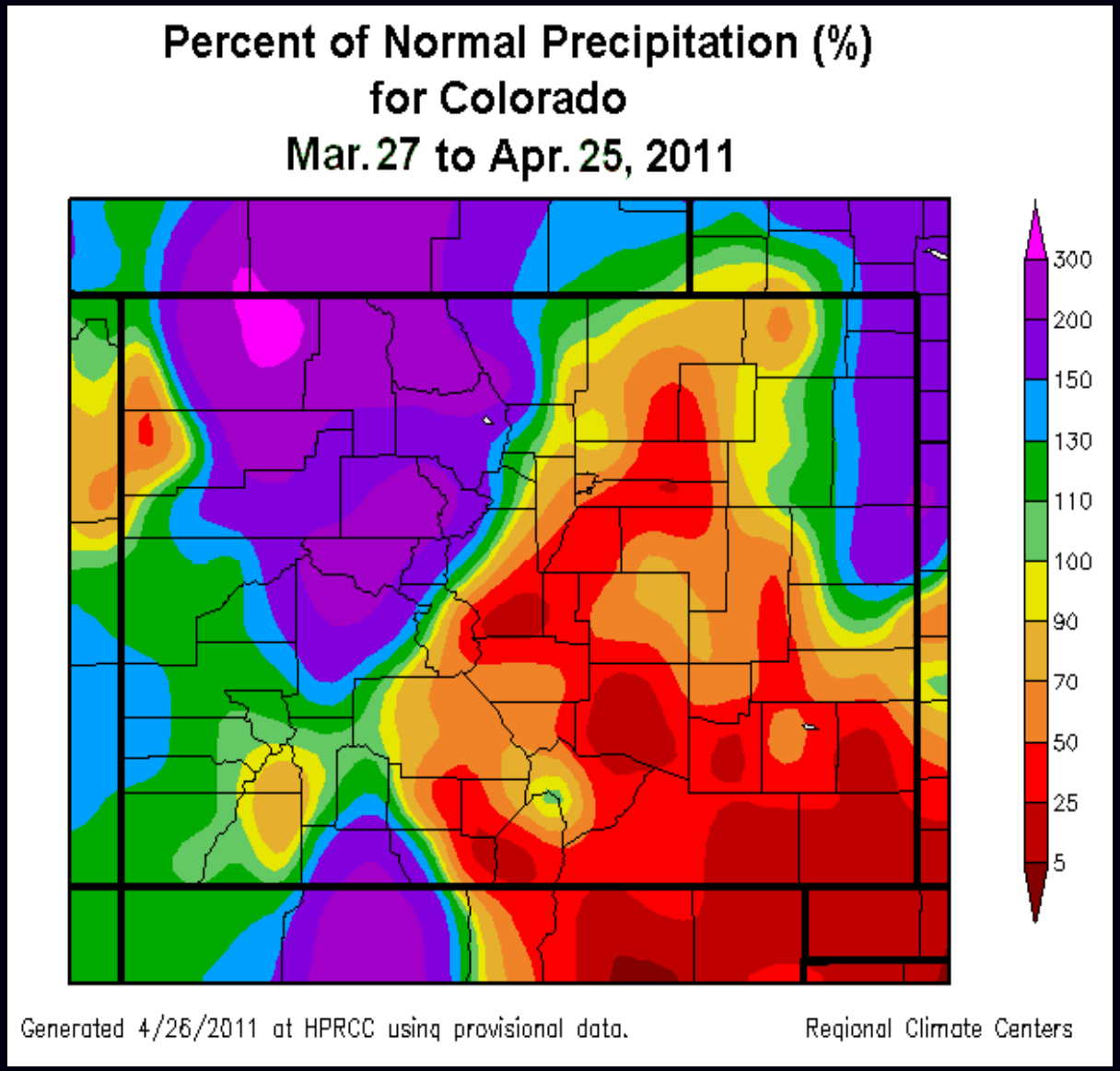
The **Standardized Precipitation Index (SPI)** was developed to monitor potential short term agricultural and long-term hydrological drought conditions. The SPI is a probability index that considers only precipitation.

Temperature, Precipitation, Snow Pack, Snow-Water Equivalence and Drought Conditions Across Colorado for the Past 30 days



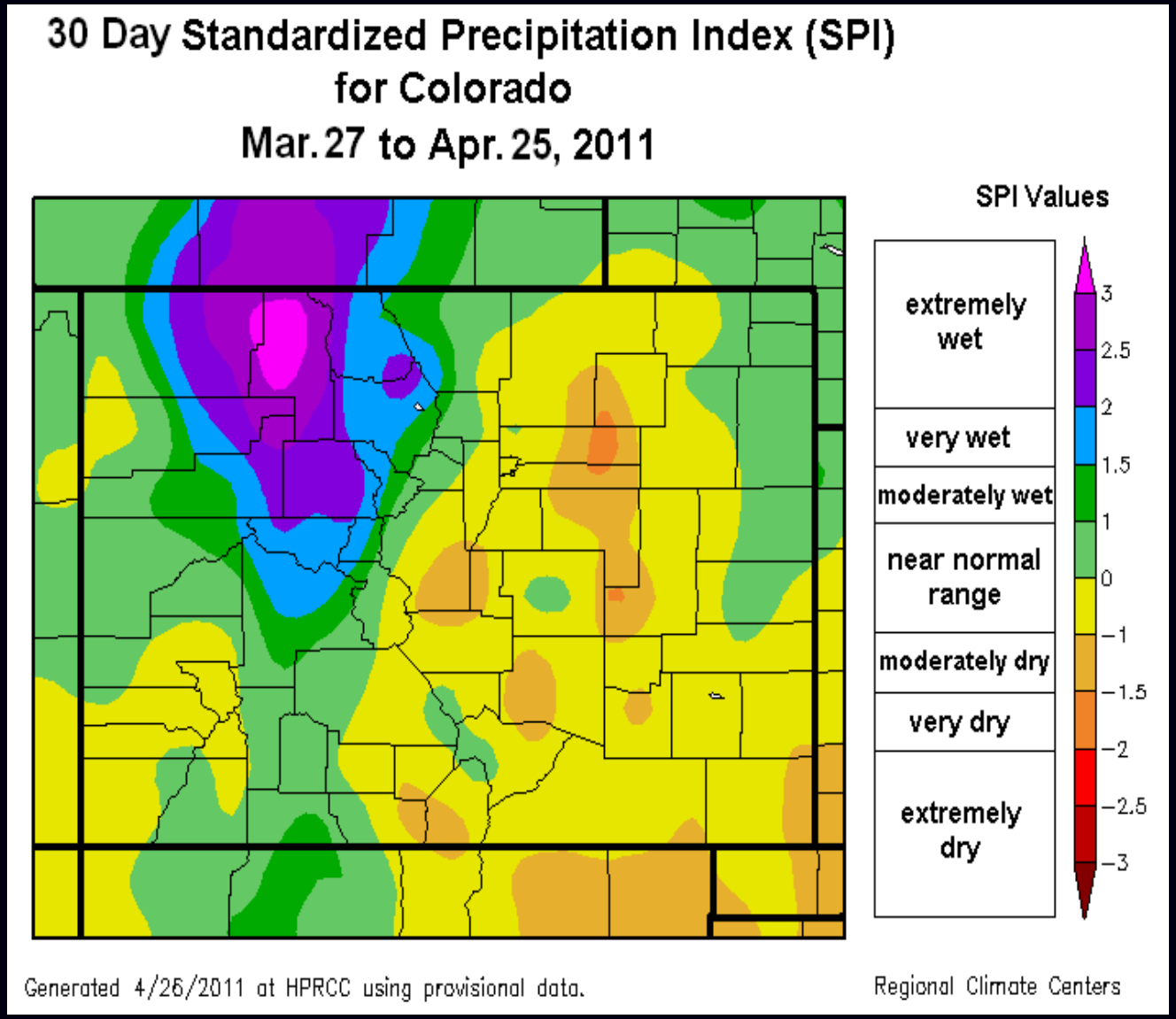
During the 30-day period ending April 25, 2011, precipitation for most of northwest Colorado remained much above normal. In areas along the Wyoming border, totals exceeded normal values by as much as 3.75 inches! Pitkin and northern Gunnison Counties in west central Colorado also saw amounts well above normal. These departures were a significant increase from those observed during the previous 30 day period. The southwest and northeast corners of Colorado also recorded above normal precipitation during the period.

The remainder of eastern Colorado and the San Luis Valley in south central Colorado saw below normal precipitation. However, these departures were a slight improvement over those observed during the previous 30-day period.



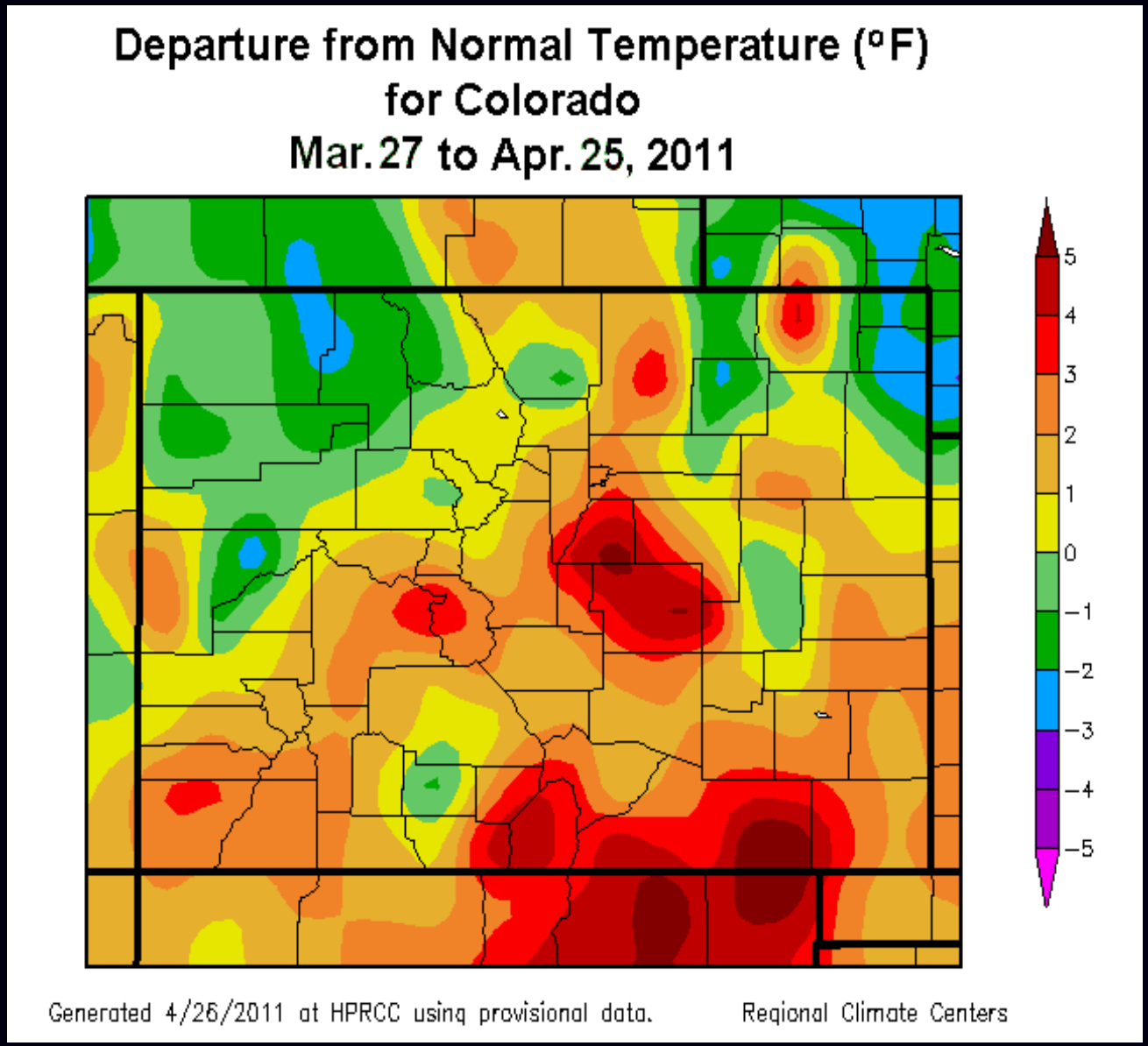
During the 30-day period ending April 25, 2011, accumulated precipitation ranged from 150 to over 300 percent above normal across most of northwest and west central Colorado. While this was just a slight increase from the previous month, areal coverage expanded significantly. The northeast corner of Colorado and the San Juan Mountains near the New Mexico border also recorded precipitation amounts in excess of 150 percent of normal.

For the rest of Colorado, precipitation was as much as 20 to 50 % below normal, with the greatest deficits observed in the Arkansas River Basin in southeast Colorado.

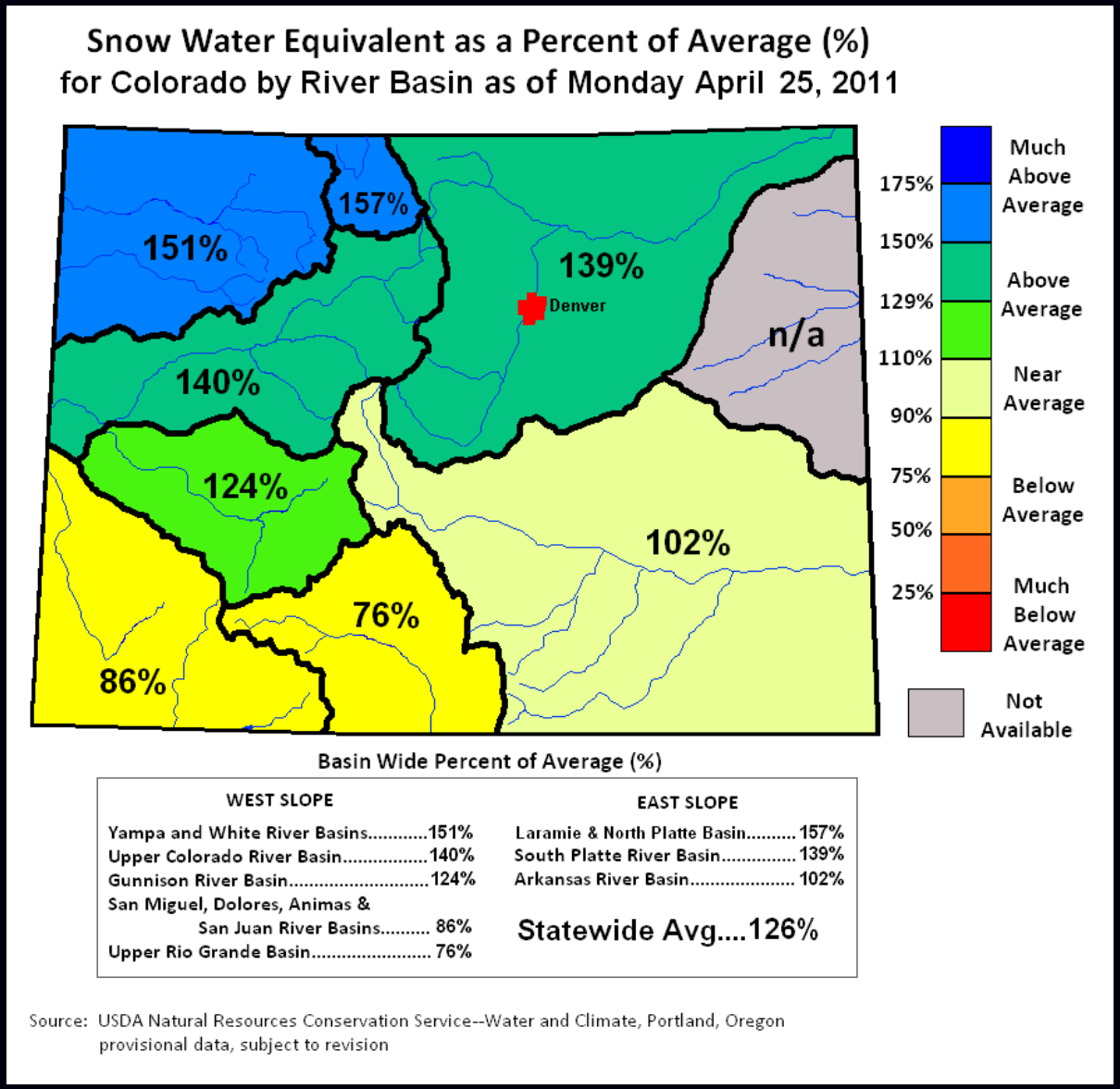


The SPI continued to indicate extreme wet conditions across northwest and west central Colorado, and moderately wet conditions in areas along the Utah border, the southwest mountains and the far northeast plains of Colorado.

Near normal to drier than normal conditions were observed elsewhere. The greatest 30-day improvement in the SPI occurred along the Front Range in northern Colorado where recent precipitation and fewer drying Chinook wind events have eased drought conditions in the area.



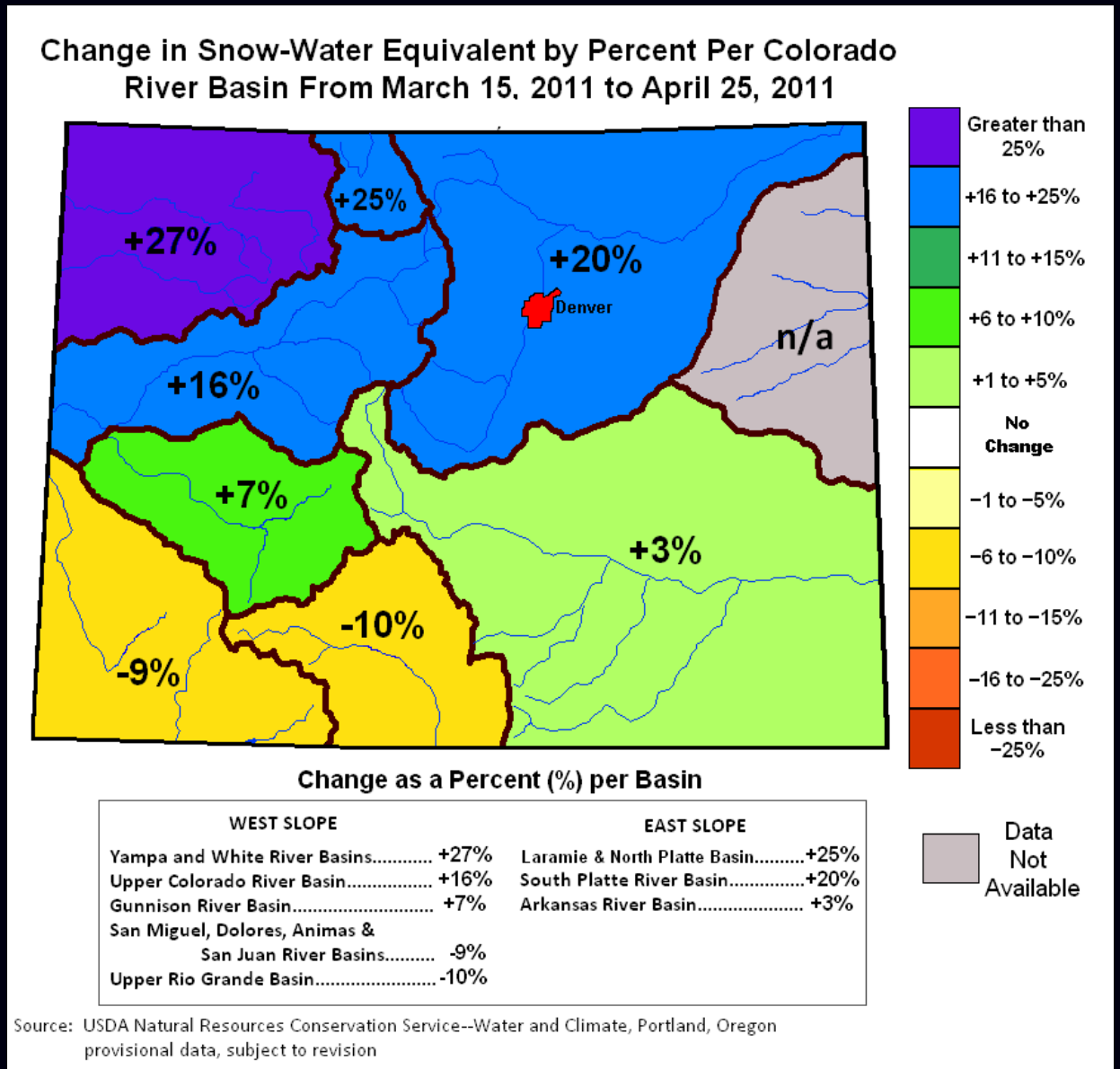
Average monthly temperatures across Colorado during the 30-day period ending April 25, 2011, ranged from 3 degrees (°F) below normal in northwest and extreme northeast Colorado, to 5 degrees (°F) above normal in east central Colorado in the vicinity of the Palmer Divide and the southeast plains along the New Mexico border.



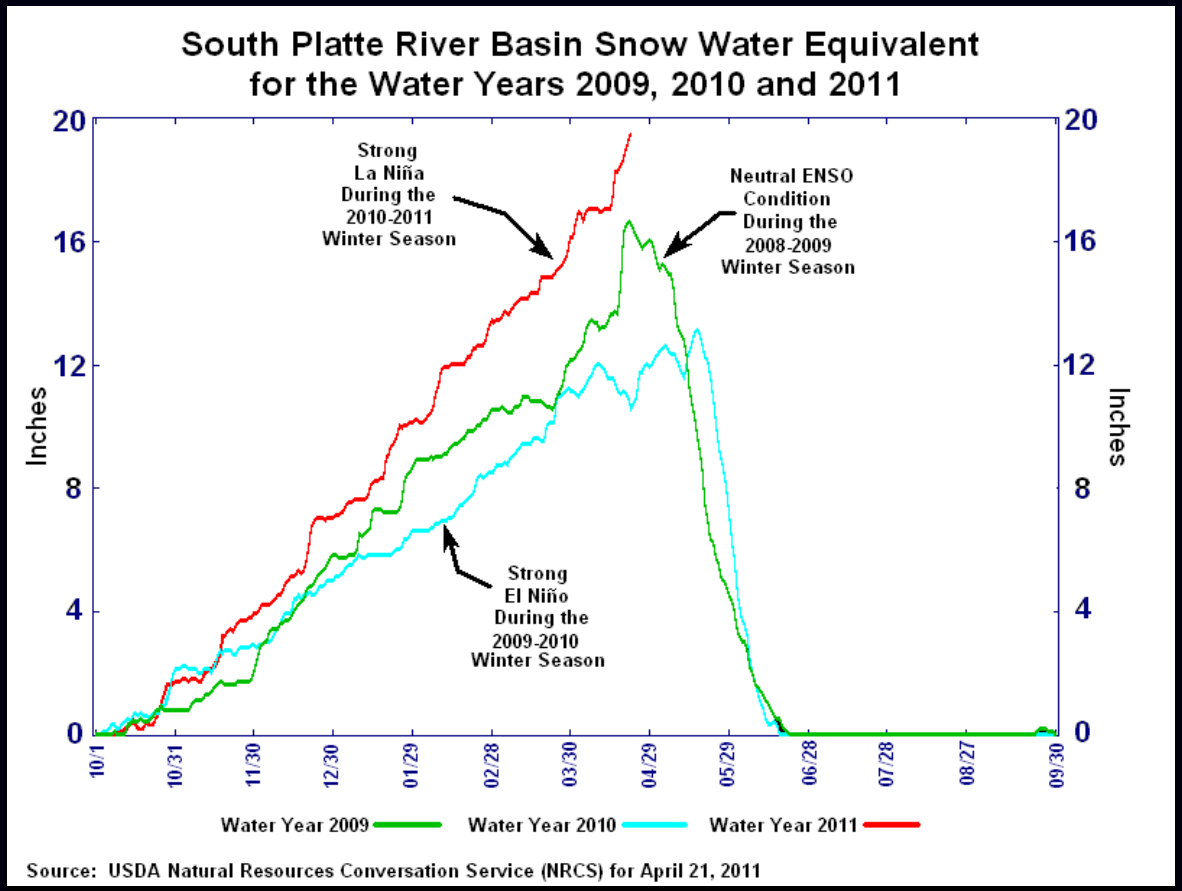
Snow water equivalents have remained well above average for the major river basins in northwest and west central Colorado as of April 25, 2011.

The South Platte River Basin in northeast Colorado saw a significant increase in snowfall during this period with its snow water equivalent now at 139 percent above average.

Conversely, the water content of snow covering the ground in the major river basins of southern Colorado continue to run below average, with the Upper Rio Grande Basin taking top honors for the "driest" area in the state. This has been the trend observed for the entire 2010-2011 water year.



Snow water equivalents have increased in all major river basins of Colorado during the period March 15 – April 25, except in the San Juan-San Miguel-Dolores and Animas River Basins in southwest Colorado and the Upper Rio Grande Basin in south central Colorado where snow-water equivalents decreased by 9 percent and 10 percent, respectively.



Snow water equivalents recorded at 27 SNOTEL sites in the mountainous terrain of the South Platte River Basin of Colorado have risen steadily since last October. Values observed this winter season, during the current strong La Niña, have exceeded values recorded during the 2008-2009 water year when neutral ENSO conditions exited and far surpassed equivalents measured during the 2009-2010 water year in the midst of a strong El Niño.

Note, a large majority of the SNOTEL sites are located near timberline, essentially exposing them to moisture baring winds from all directions (see map in the upper right.)

Even as La Niña continues to weaken, it may continue to influence the weather across Colorado well into June.

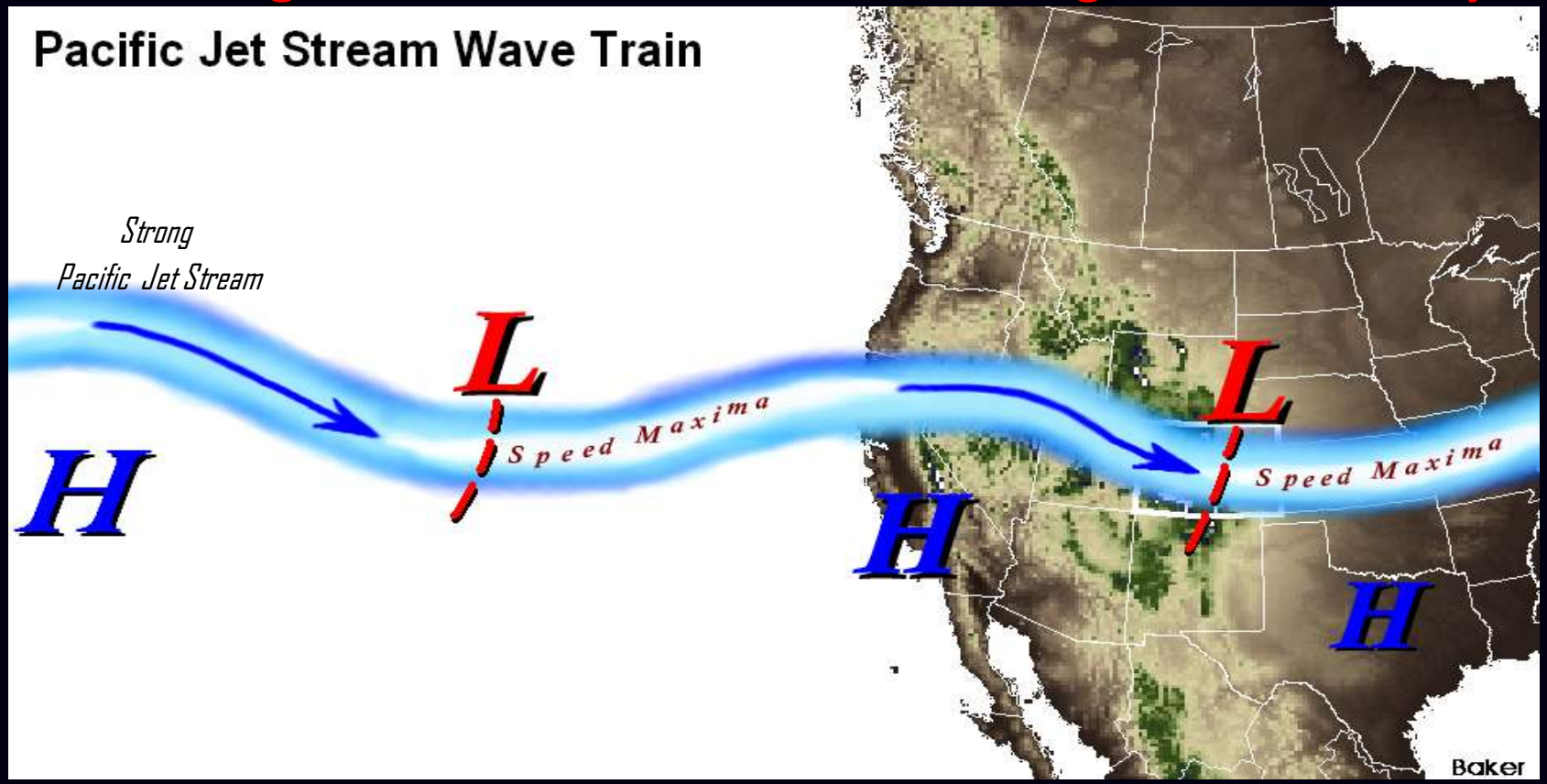
More Heavy Snowfall for the Mountains During May

Continued Drought East – New Drought Southwest

An Increased Risk of Hail Storms on the Plains

An Increased Risk of Damaging T-Storm Winds

Prevailing Pacific Jet Stream Pattern During the Past 30 Days



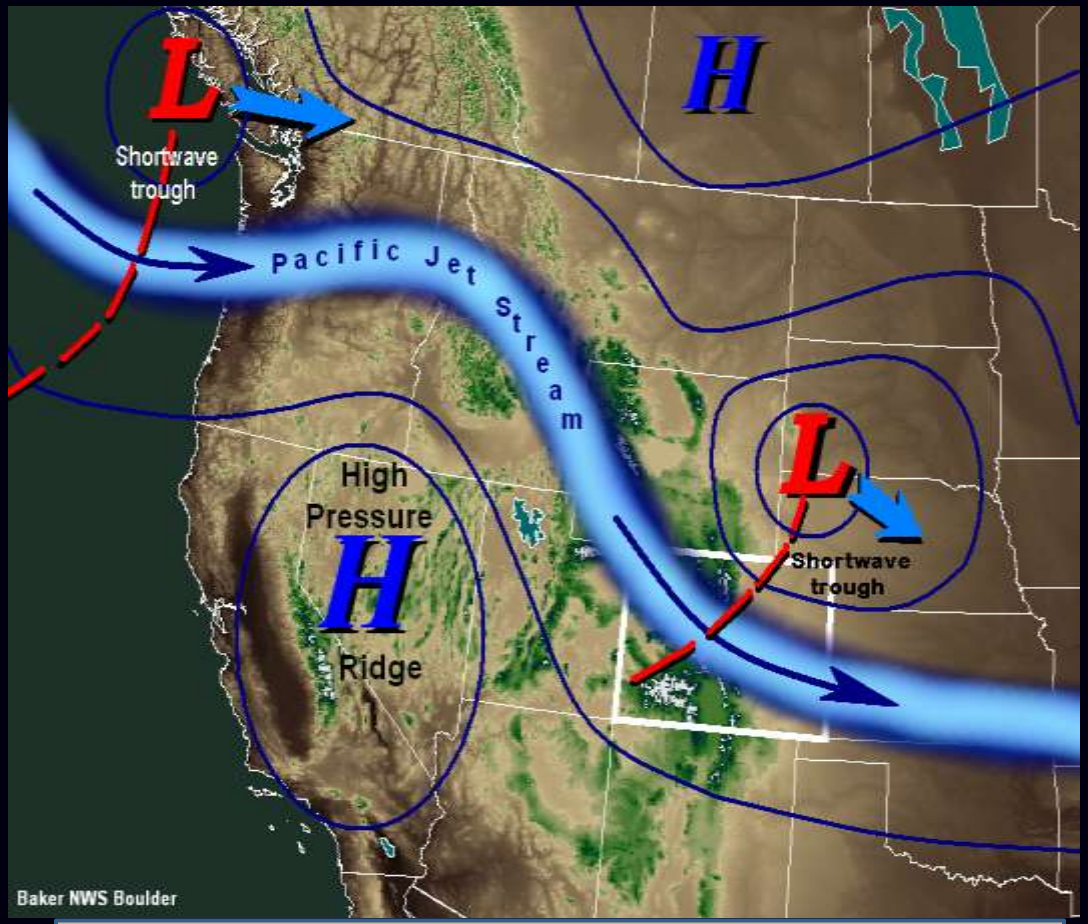
During the past 30 days, a series of upper level low pressure troughs or “waves” propagated across the Pacific Ocean along an abnormally strong Pacific Jet Stream. These areas of disturbed weather were responsible for producing the strong wind and heavy snowfall in the mountains of northern and central Colorado on numerous occasions and the strong and gusty downslope winds that often developed in the lee of the Front Range. In the last couple of weeks several bands of showers have managed to move off the mountains and onto the plains. Though most of this precipitation has been light, the welcomed moisture has eased drought conditions mainly within the South Platte River Basin.

Late Season Snowfall and Cold Snaps

At the conclusion of a moderate to strong La Nina, it is not uncommon to see short periods of well below normal temperatures and also snowfall on the plains of northeast Colorado well into May.

Snowfall is usually light, but the unseasonably cold temperatures can pose a serious threat to young outdoor plants, early season crops and newly born livestock.

“Beware of Northwest Flow”



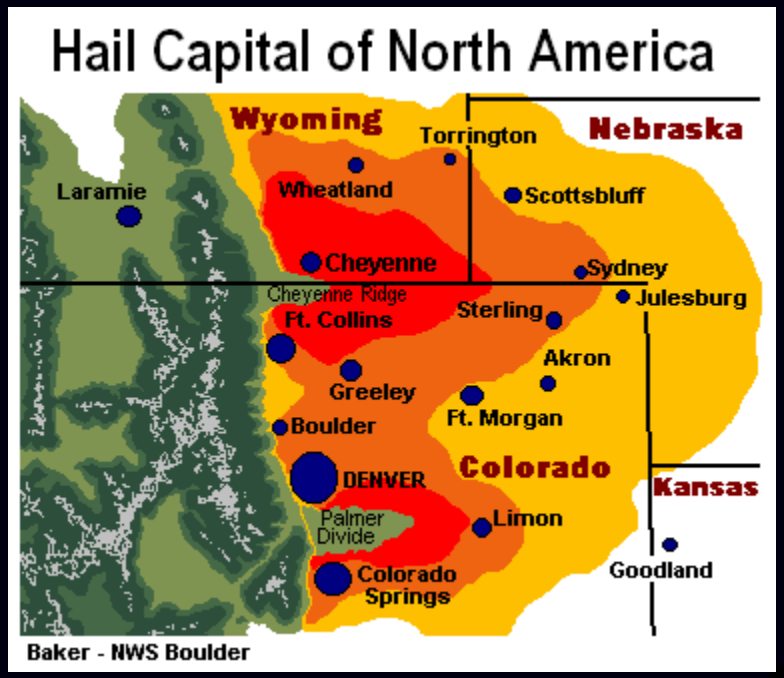
Thunderstorms generated by this upper level wind pattern are more likely to produce large hail (sometimes to great depths), damaging outflow winds and even tornadoes.

With La Niña coming to an end, the Pacific jet stream will continue to weaken as it migrates northward to higher latitudes.

As the jet stream bows northward up the west coast, temperatures will soar across the western continental United States (CONUS) beneath a strengthening ridge of high pressure. As this ridge builds northward, the upper level flow over the northern Rockies and the northern and central Great Plains will become increasingly northwesterly in direction. Weather disturbances or “shortwave troughs” carried along by this strongly sheared, fast moving flow of air aloft are usually responsible for producing much of the severe weather observed east of the Rocky Mountains during May and June. The threat of severe weather in northeast Colorado increases significantly during this period and usually peaks during the first half of June.

Springtime
Along the Colorado Front Range

Front Range weather during the spring can change abruptly and sometimes violently. One day can be unseasonably warm and humid with towering thunderstorms producing damaging hail and wind; the next blustery cold and snowy. And, it's not unheard of to see all of this turbulent weather occurring during a single day.



Hail Season is Upon Us

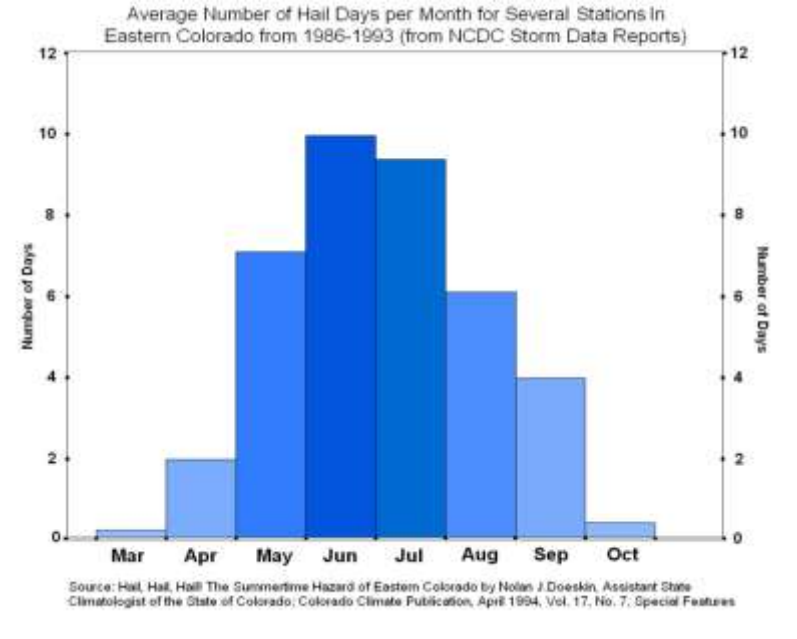
"The lee side of the Rocky Mountains, namely eastern Colorado (and southeast Wyoming), has the nations' greatest hail frequency, the greatest hail intensity with the largest average hailstones, the highest average number of hailstones, and the longest hail storm durations."

Stanley A. Changnon, David Changnon and Steven D. Hilberg, "Hailstorms Across the Nation – An Atlas About Hail and Its Damages", Illinois State Water Survey, Champaign, IL November 2009

The greatest average frequency of hailstorms is the vicinity of Cheyenne, Wyoming along the Cheyenne Ridge.

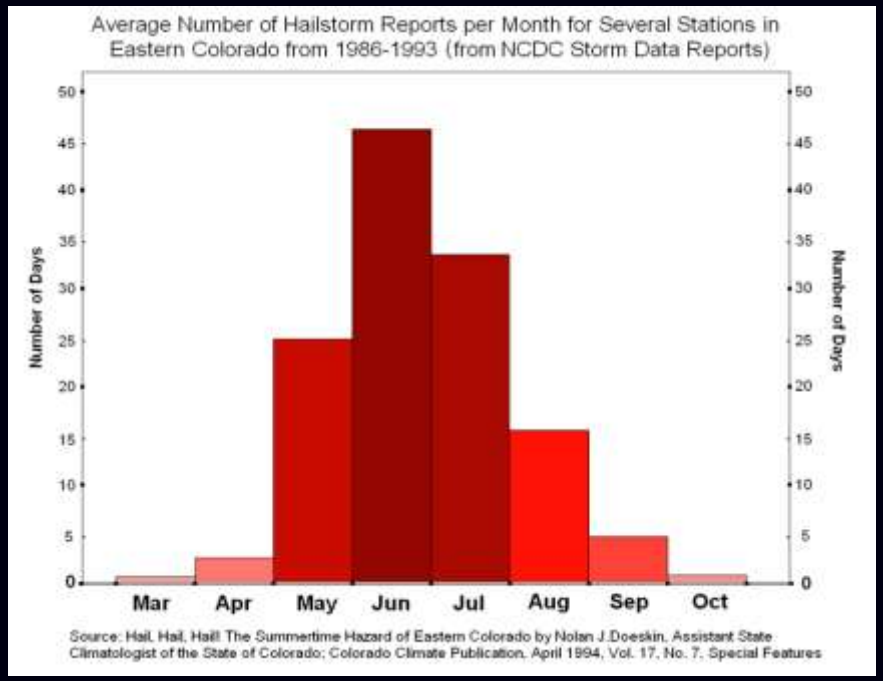
A second area of high frequency exists along the elevated terrain separating Denver and Colorado Springs known as the Palmer Divide.

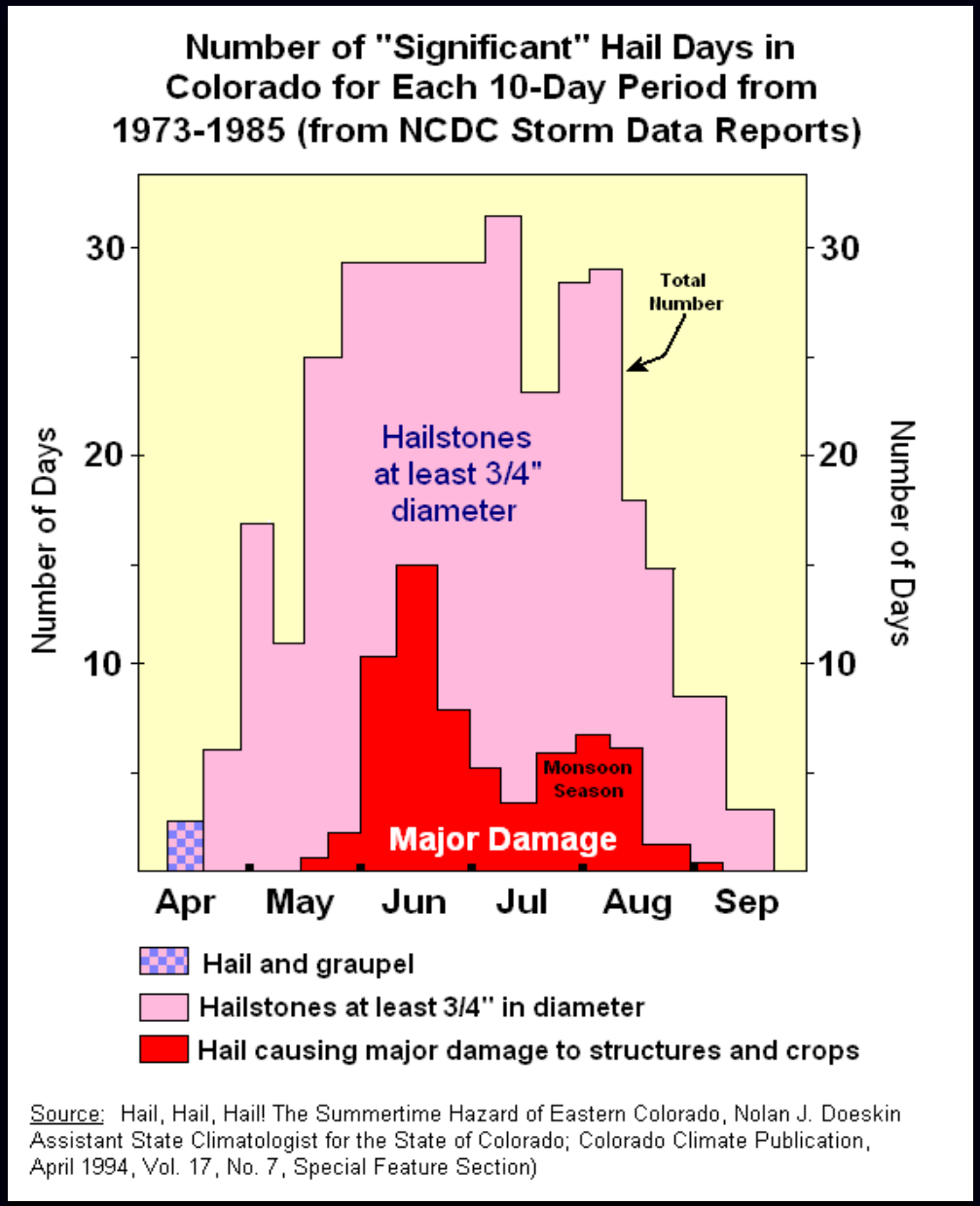
Hail poses a serious danger to life and property, especially when driven by powerful thunderstorm winds.



The hail season in eastern Colorado quickly ramps up during the month of May. By early June the season is normally in full swing. By August, hail days start to drop off as the late summer atmosphere begins to dry out and the upper levels of the troposphere continue to warm and stabilize.

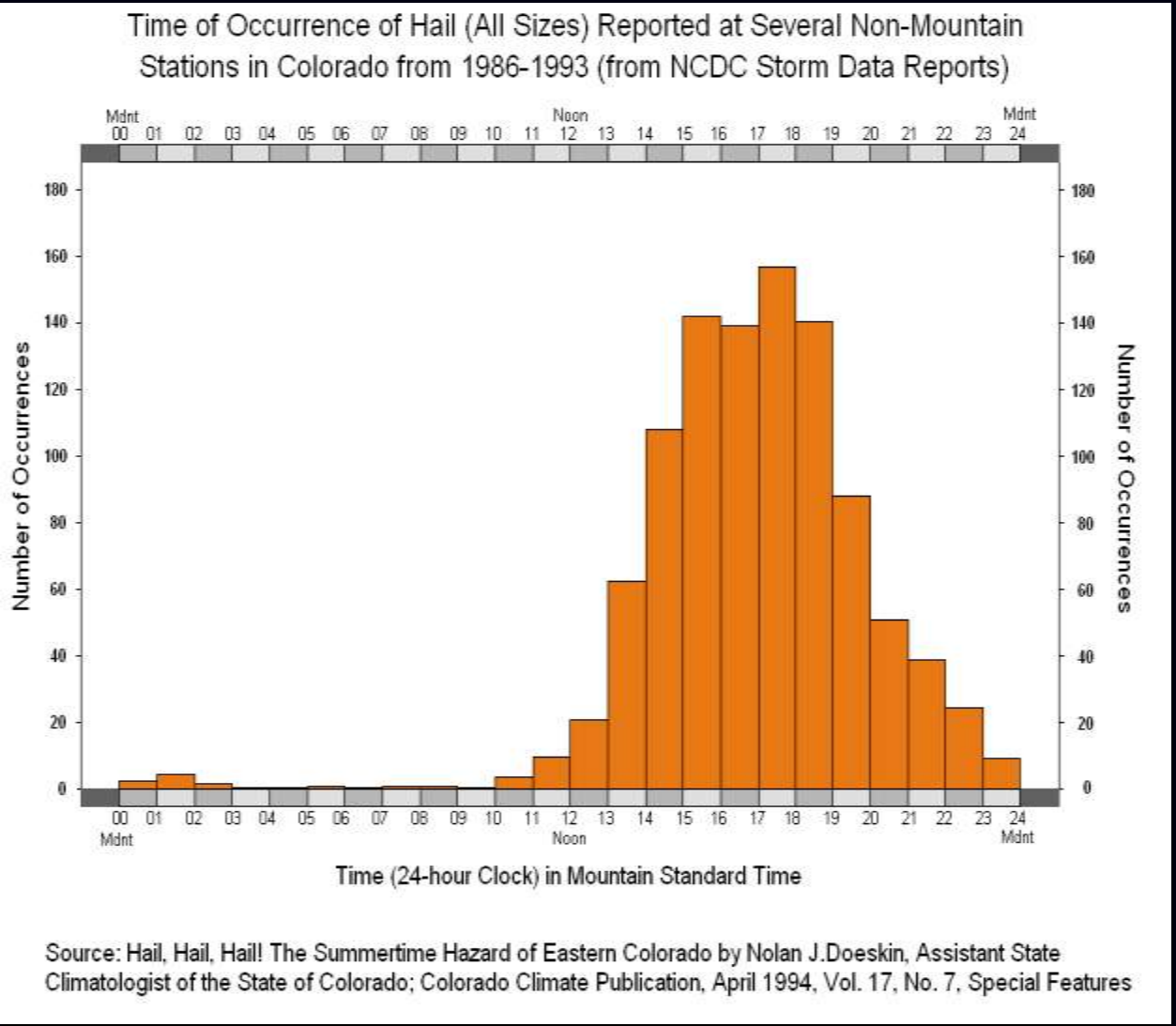
The number of hail days and hailstorm reports per day peak in June, with July being the second most active month for hail in eastern Colorado.





As was shown in the previous slide, the occurrence of hail in eastern Colorado rises dramatically in May, with a peak in June. June is also the month when hail is most likely to produce major damage to property and crops.

A second peak in damaging hail storms occurs in late July and early August when we normally see a resurgence in the daily occurrence of thunderstorms during the so-called “summer monsoon season.”

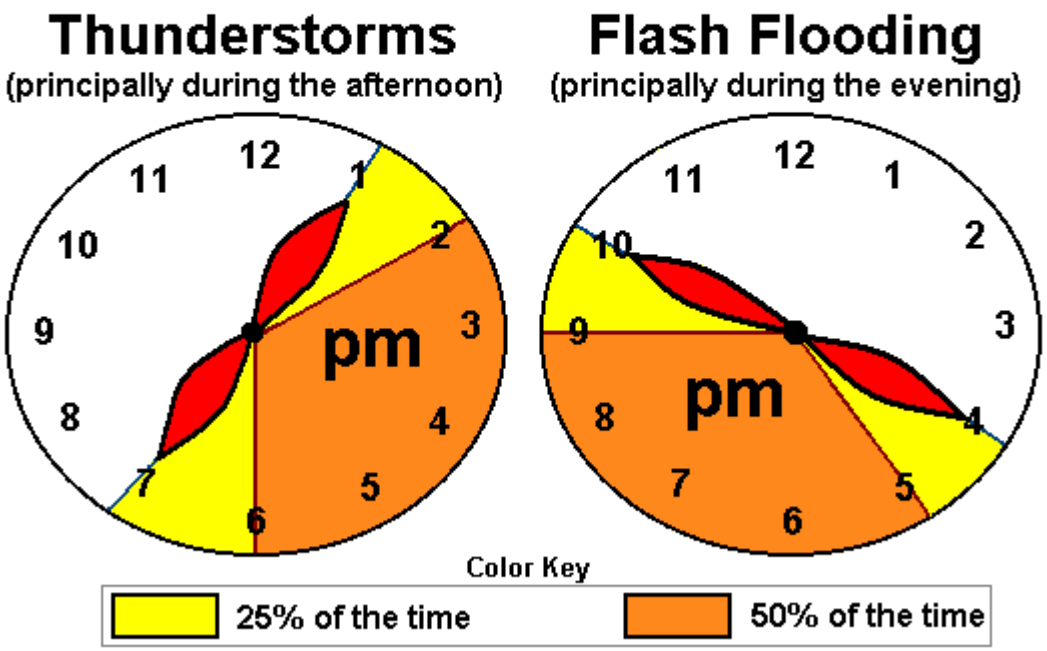


Source: Hail, Hail, Hail! The Summertime Hazard of Eastern Colorado by Nolan J.Doeskin, Assistant State Climatologist of the State of Colorado; Colorado Climate Publication, April 1994, Vol. 17, No. 7, Special Features

The time of occurrence of hail in Colorado closely matches with daily cycle of thunderstorm development during the spring and summer.

In Colorado, thunderstorms are more likely to form as a result of strong daytime heating in an atmosphere with a sufficient amount of humid air, particularly near the ground. Once a critical air temperature is reached, strong updrafts form producing towering clouds that grow into thunderstorms. Most of this convective activity begins around midday, and will then continue through the afternoon during the period of maximum heating. This is also when hail occurrence peaks, normally around 5 to 6 pm.

Average Occurrence of Thunderstorms and Flash Flooding Along the Colorado Front Range from May through August

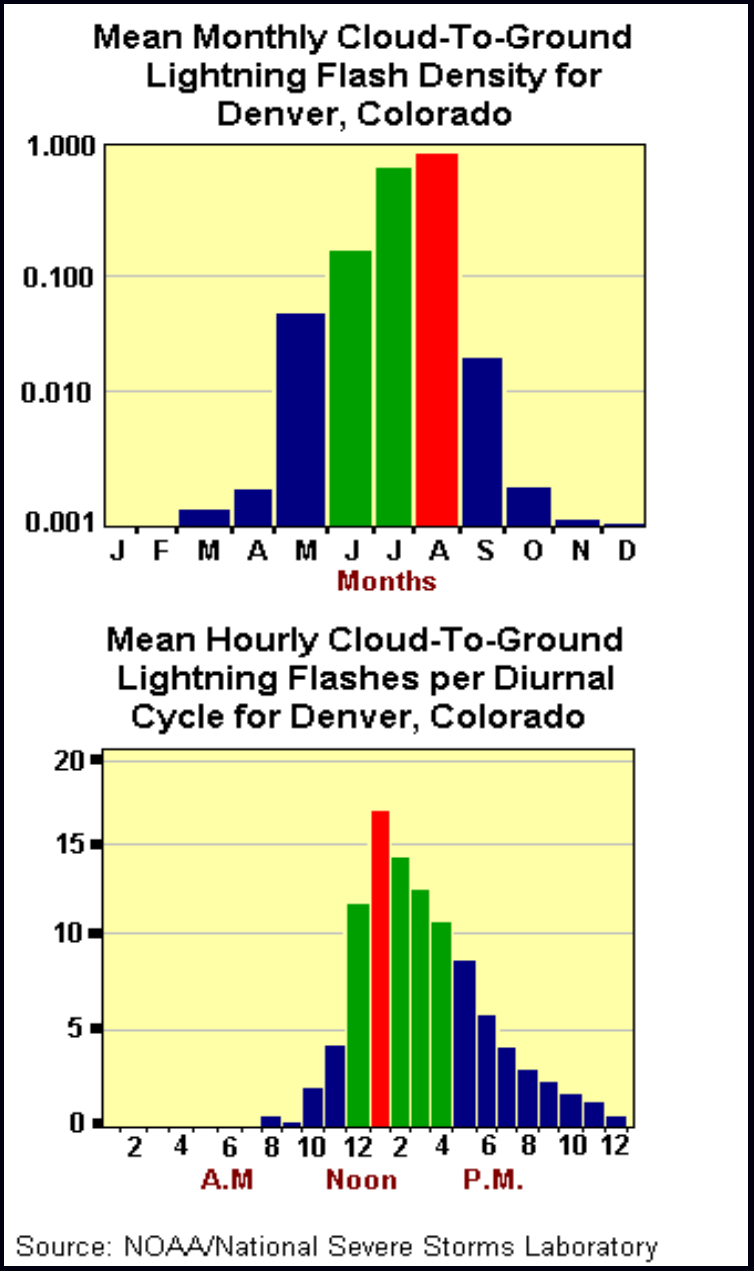


Baker - NWS Boulder

As mentioned in the previous slide, thunderstorms in Colorado during the spring and summer are most likely to form during the afternoon and early evening when temperatures are at their warmest. Thunderstorms in northeast Colorado will usually form first over the heated slopes of the Front Range before drifting out over the adjacent high plains.

Most thunderstorms along the Front Range occur from 2 pm to 6 pm, although thunderstorms can and do occur at anytime of the day or night.

Though less frequent, thunderstorms during the late afternoon and evening hours are often slow movers due to lighter winds aloft at that time of day. These late day storms are often responsible for most of the flash flooding over and along the Front Range, particularly during July and early August.



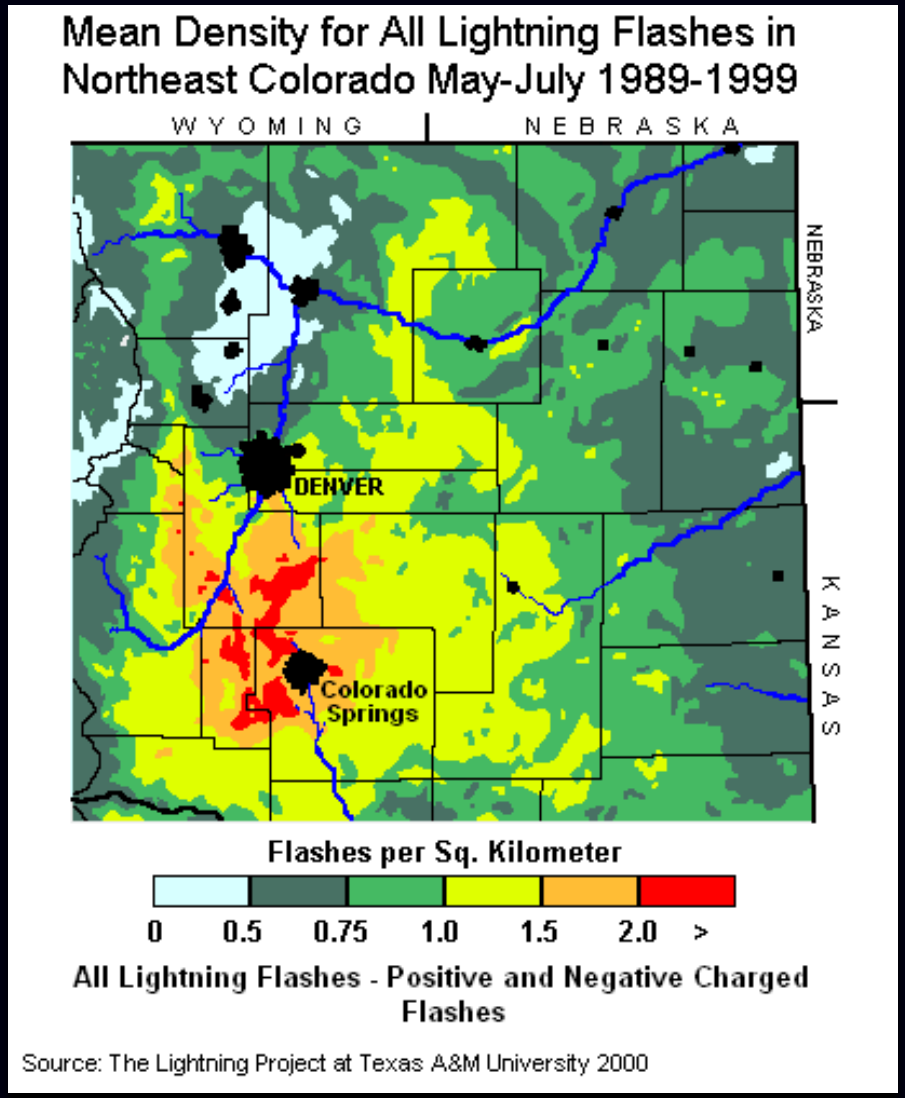
The Lightning Threat Along the Colorado Front Range

Along the Front Range in northern Colorado, lightning frequency increases steadily during the months of May, June and July, and normally peaks during the month of August.

On average, lightning frequency in the Denver area peaks early in the afternoon with the initial wave of thunderstorms moving off the Front Range. Its frequency will then decrease through the afternoon as thunderstorm activity shifts further out onto plains.

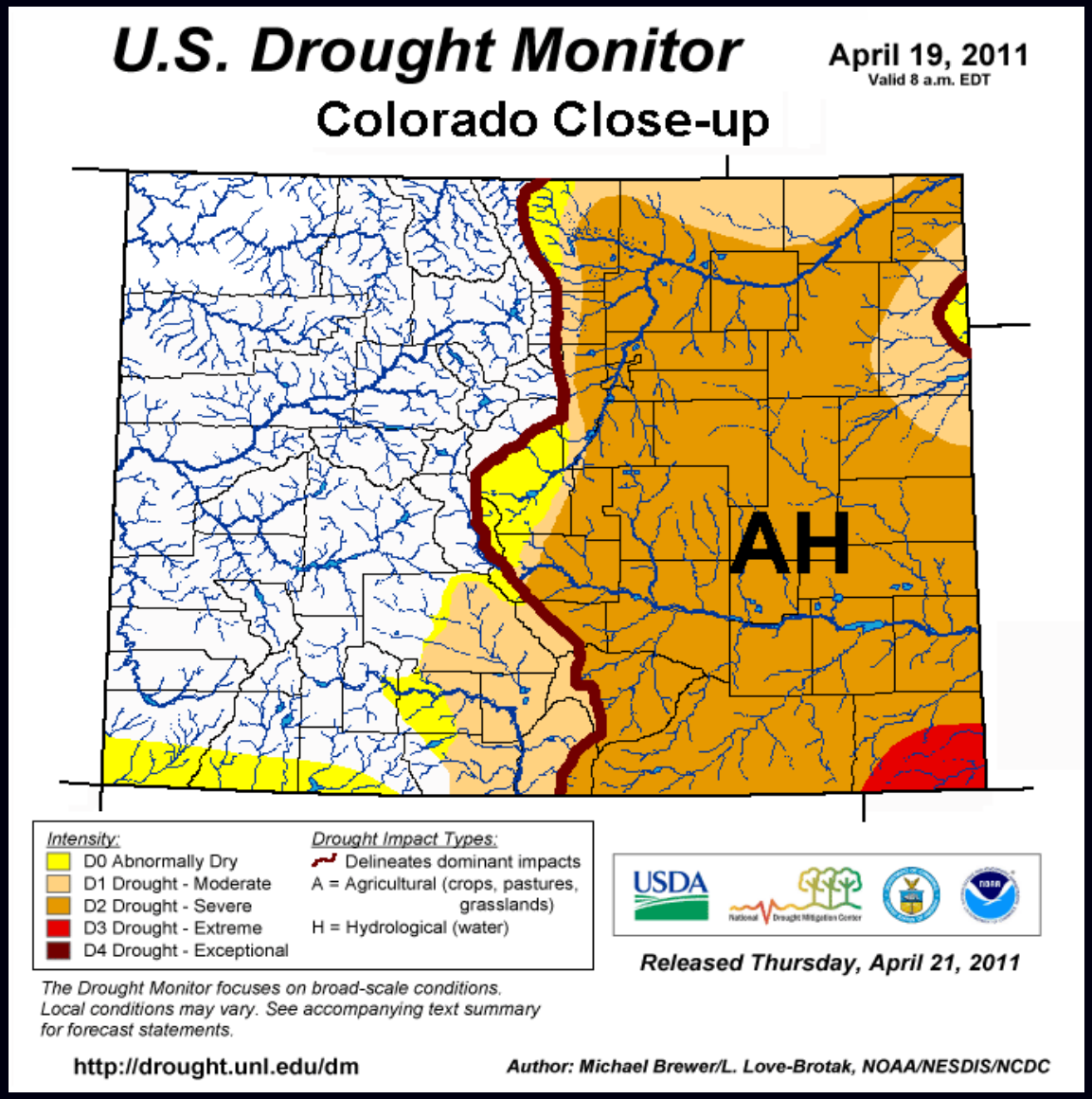
Lightning in the Denver area is also more likely to occur later in the day as we move further into summer. This is because of a strengthening temperature inversion aloft that can delay and even inhibit the formation of a thunderstorm.

One of the Most Active Regions for Lightning in the United States



The Lightning Project conducted by Texas A&M University in 2000 revealed that cloud-to-ground lightning were most likely to occur over the elevated terrain between Denver and Colorado Springs known as the Palmer Divide. Noteworthy was the high frequency of lightning detected around Colorado Springs. This is also an area of high hail occurrence.

This study, covering ten years of lightning flashes (both positively and negatively charged strokes), also revealed an area of low lightning activity around the Front Range cities of Longmont, Loveland and Fort Collins. No clear explanation was offered for this lack of electrical activity in this area.



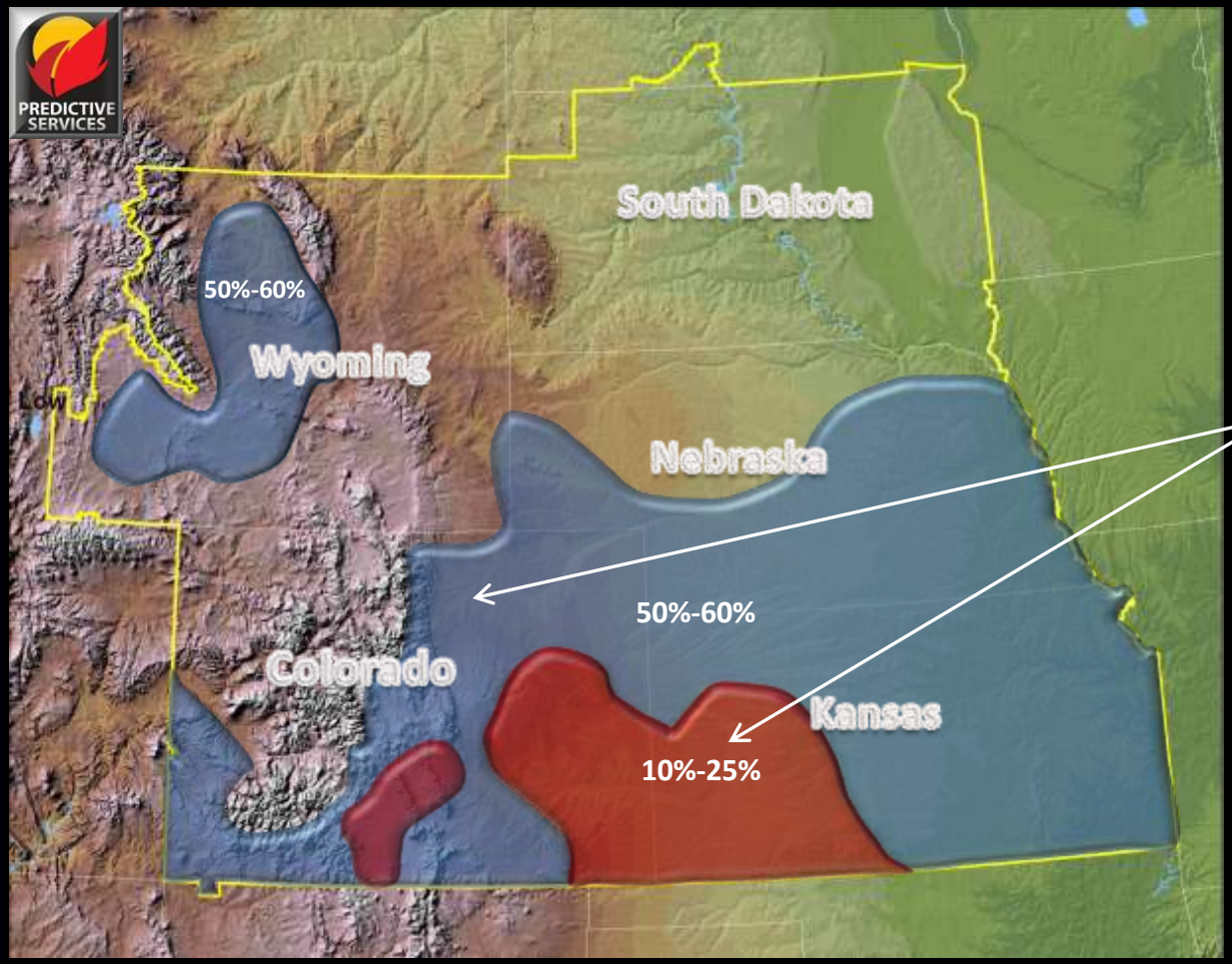
As of April 19, 2011, the U.S. Drought Monitor indicated moderate (D1) to severe (D2) drought conditions over nearly all of eastern Colorado, with extreme drought conditions (D3) in the far southeast corner of the state. As indicated, the main impact was to both agricultural and hydrological interests.

This map also indicates abnormally dry (D0) to moderate (D1) drought conditions in the San Luis Valley of southern Colorado, near the southwest border of the state, on the east slopes of the La Garita, Rampart and northern Front Range mountains, and the far northeast corner of Colorado.

The Wildland Fire Threat

Rocky Mountain Area

9-Month Percent of Average Precipitation



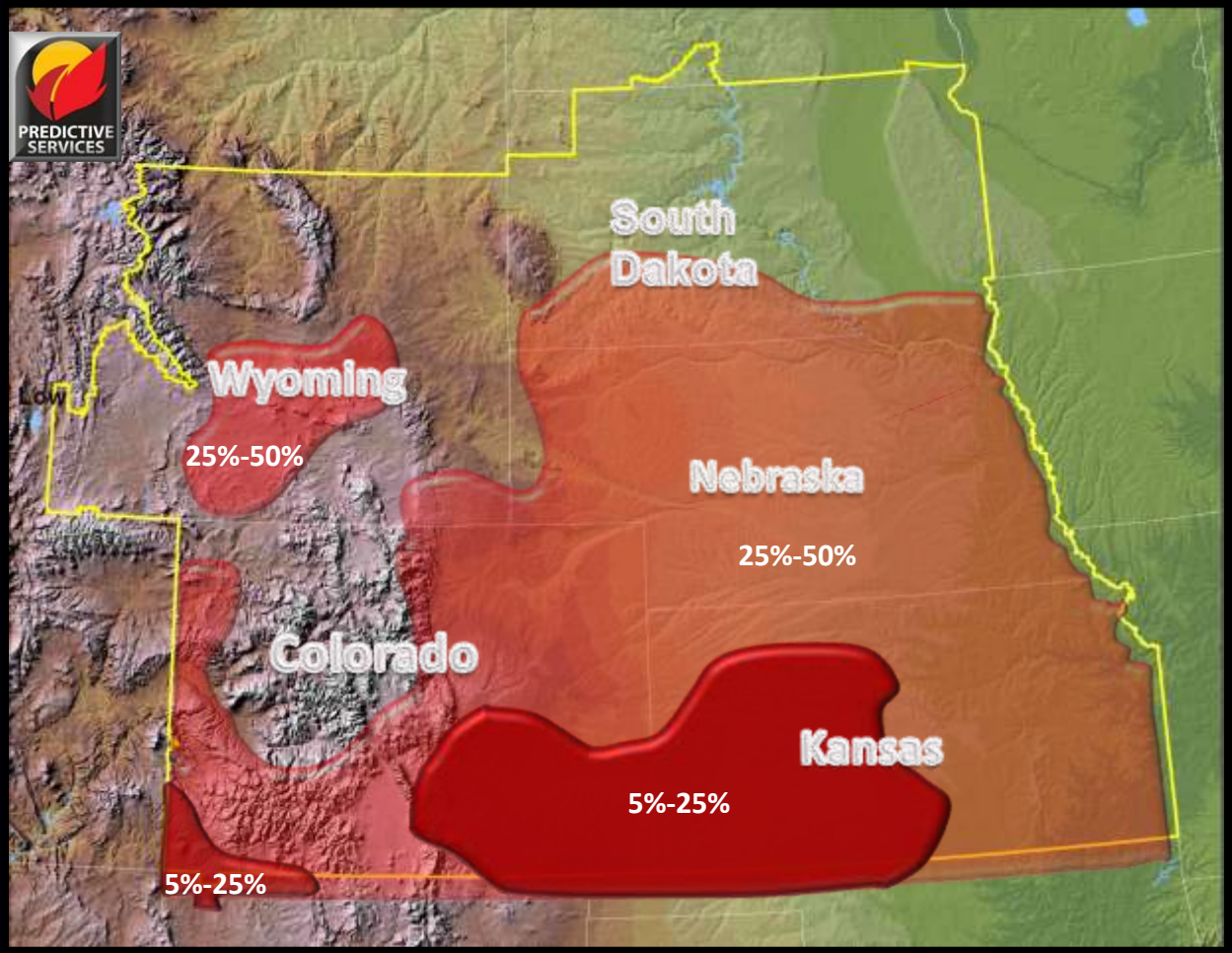
Dry Period Began Late Summer 2010

- 50%-60% of Average
- 5%-25% of Average

The following Predictive Services maps were provided by
Tim Mathewson – BLM/RMCC
GACC Meteorologist, Lakewood, Co

Rocky Mountain Area

30-Day Percent of Average Precipitation

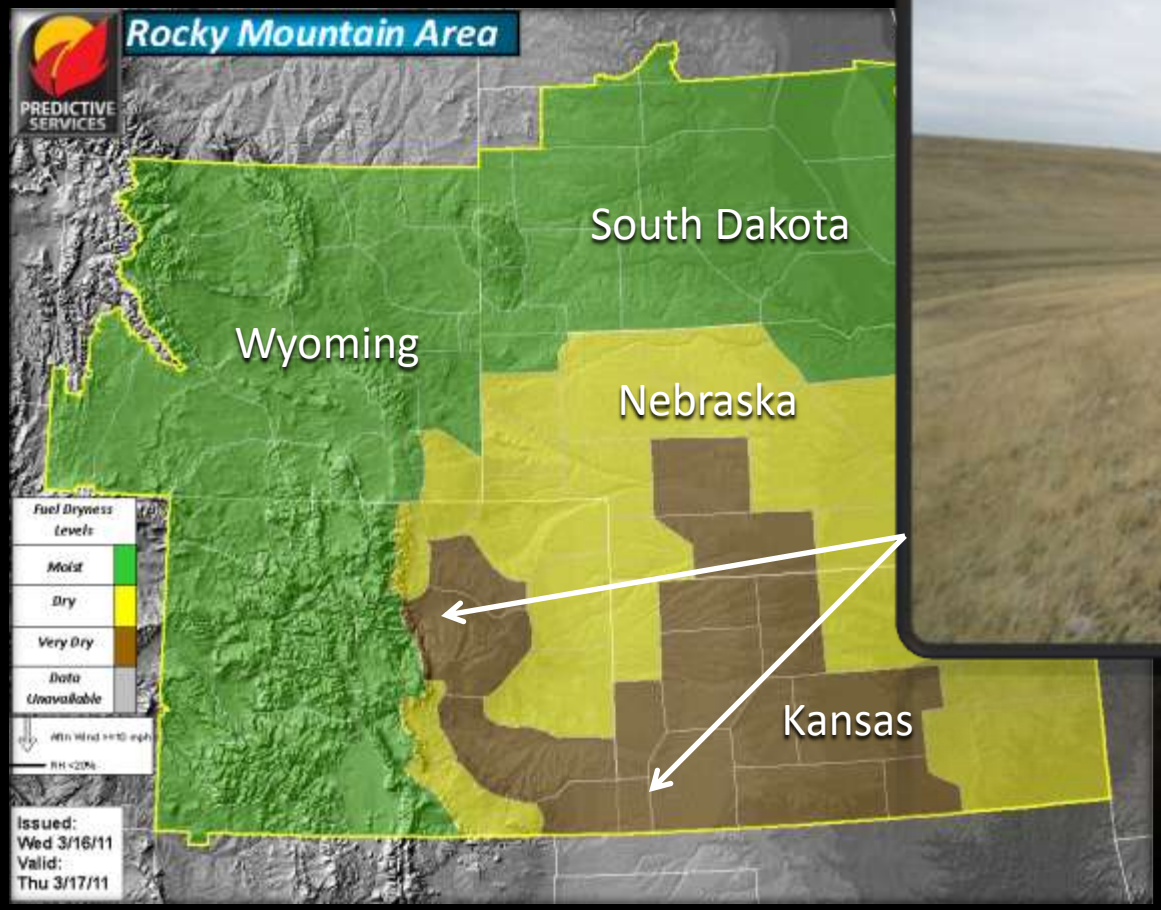


The Last 30-Days

- 5%-25% Average
- 25%-50% Average

Rocky Mountain Area

Dryness Levels and Fuels

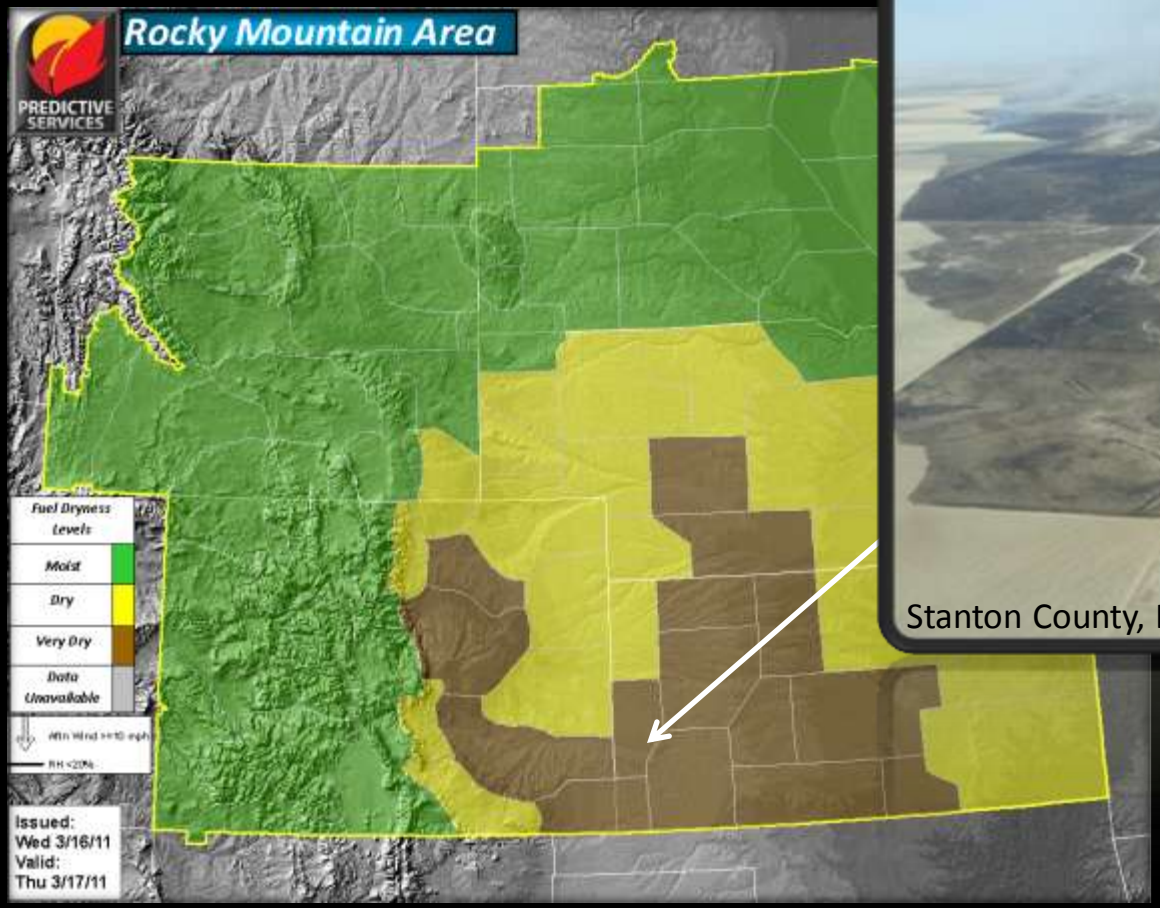


Significant Grass Fuel Loading From the 2010 Growing Season

Minimal new grasses due to the lack of precipitation below average soil moisture

Rocky Mountain Area

Dryness Levels and Fuels



Stanton County, KS- March 22, 2011- 38,000 Acres

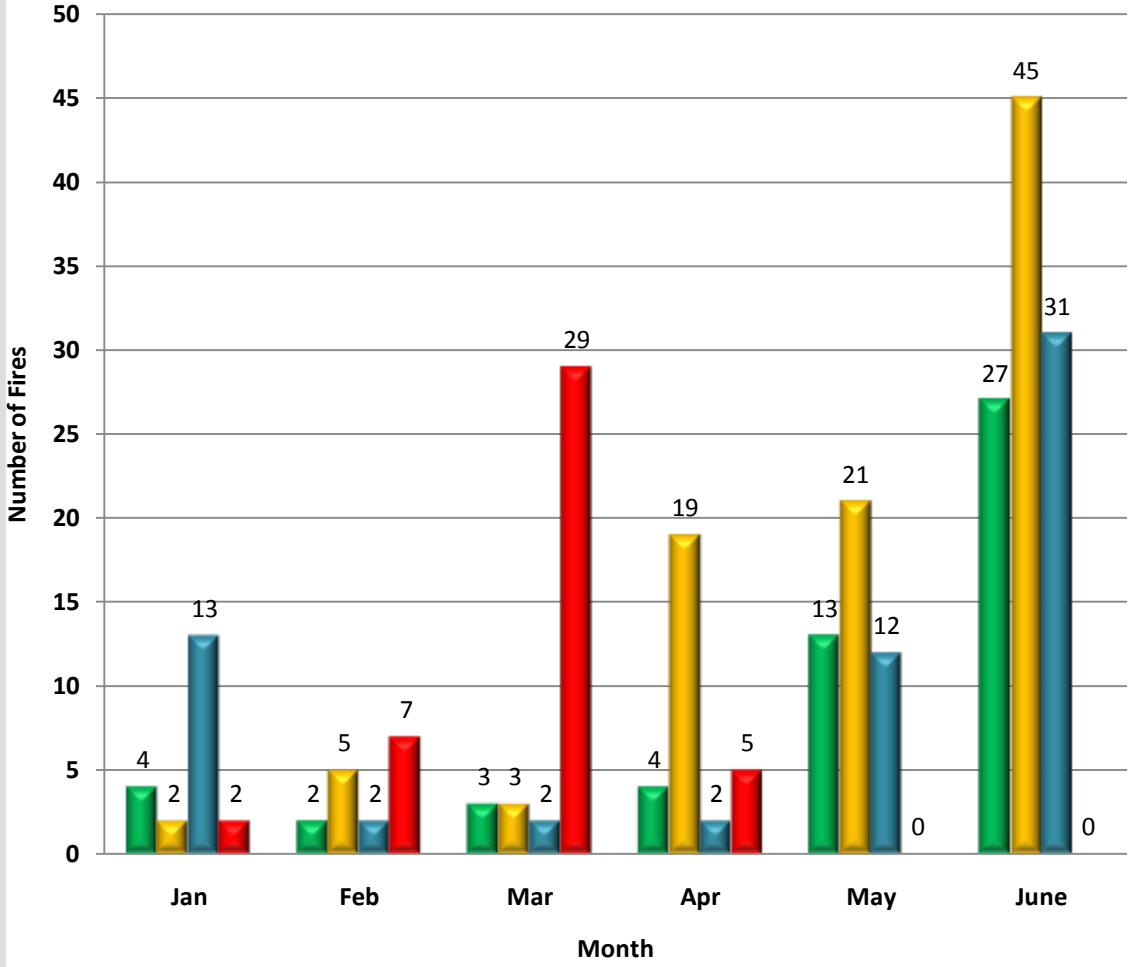
Significant Grass Fuel Loading From the 2010 Growing Season

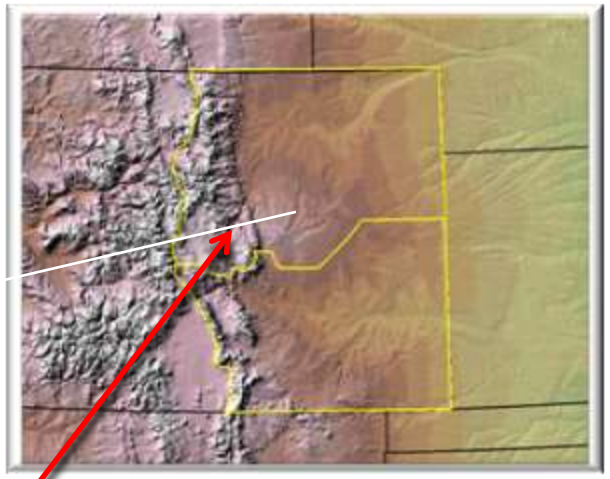
Minimal new grasses due to the lack of precipitation below average soil moisture

Rocky Mountain Area

2011 Fire Occurrence

Northeast Colorado Fire Occurrence





Northeast Colorado Average Number of Fires 1994-2009

Northeast Colorado Number of Fires 2002

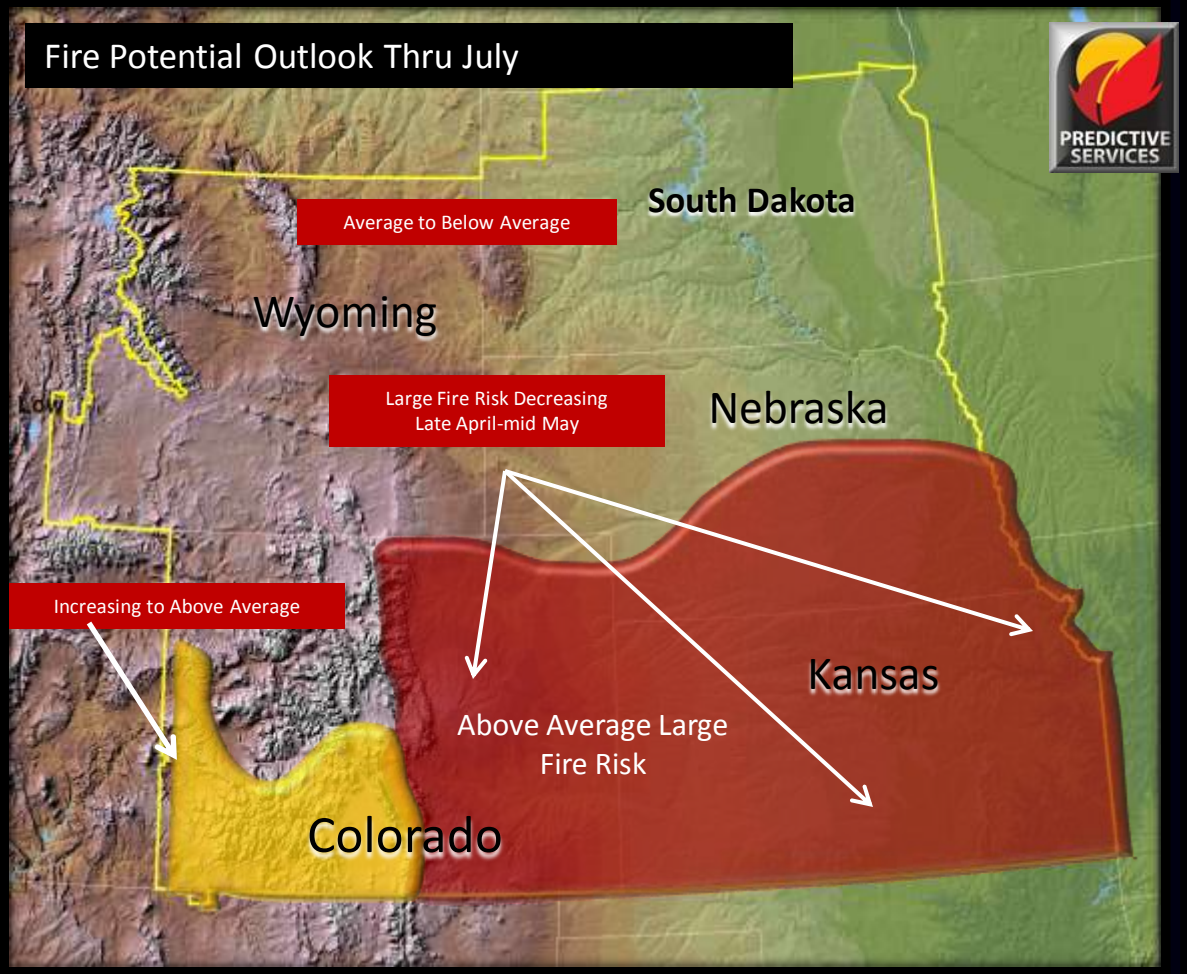
Northeast Colorado Number of Fires 2008

Northeast Colorado Number of Fires 2011

June of 2002 the Hayman Wildfire occurred southwest of Denver; the largest wildfire in Colorado's recorded history.

Rocky Mountain Area

2011 Fire Potential Outlook



La Niña is forecast to weaken thru June 2011, similar to 2008.

Greenup and higher humidity will decrease fire potential across the plains.

Dependent on the strength or how quickly La Niña weakens, onset of the SW Monsoon may be delayed.

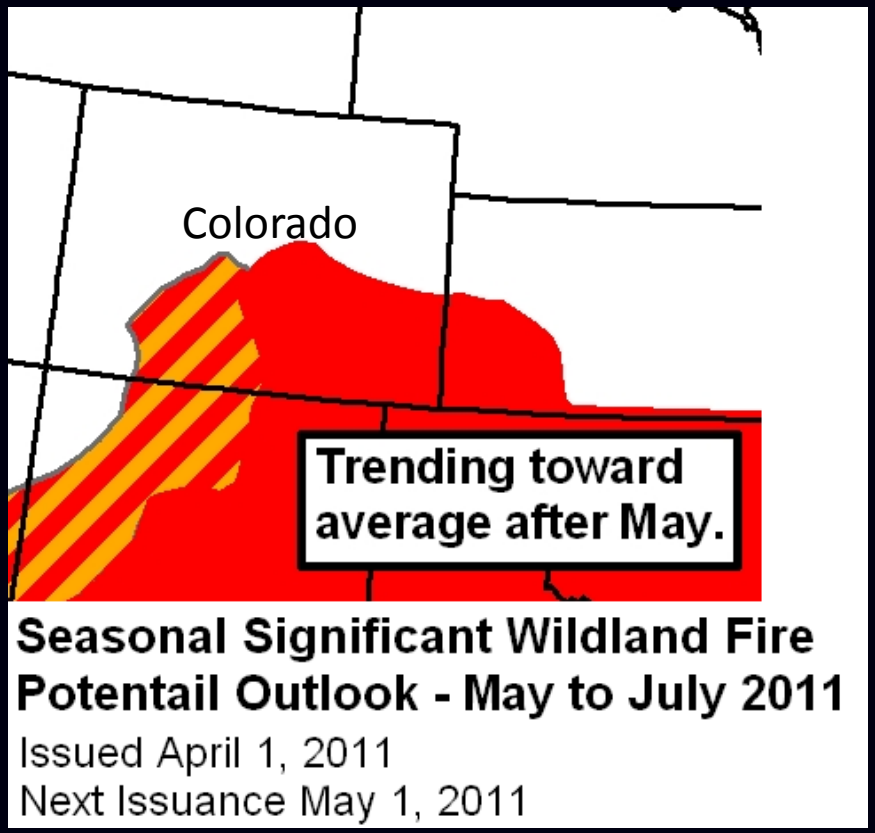
Extent of green-up is unknown and will be dependent on precipitation amounts and duration.

Current trends indicate above average potential in southwest Colorado, with a typical seasonal increase in fire potential northward.

Return of La Nina possibly late this summer could rekindle a dry pattern resulting in another increase in fire activity in September and October across much of the RMA.

Wildcard: Ignition?

Seasonal Significant Wildland Fire Potential Outlook – May to July 2011



Predictive Services at the National Interagency Coordination Center in Boise, Idaho predicts that the potential for significant wildland fire will persist across southeast Colorado through this spring, but with a trend toward average conditions after May.

As conditions warm and dry west of the Continental Divide, portions of southwest Colorado could see a significant increase in fire potential in the coming months.

Map produced by Predictive Services, National Interagency Coordination Center Boise, Idaho
Issued: April 1, 2011
Next Issuance:May 1, 2011

Temperature and Precipitation Composites and Outlooks For May-June-July 2011 From NOAA's Climate Prediction Center

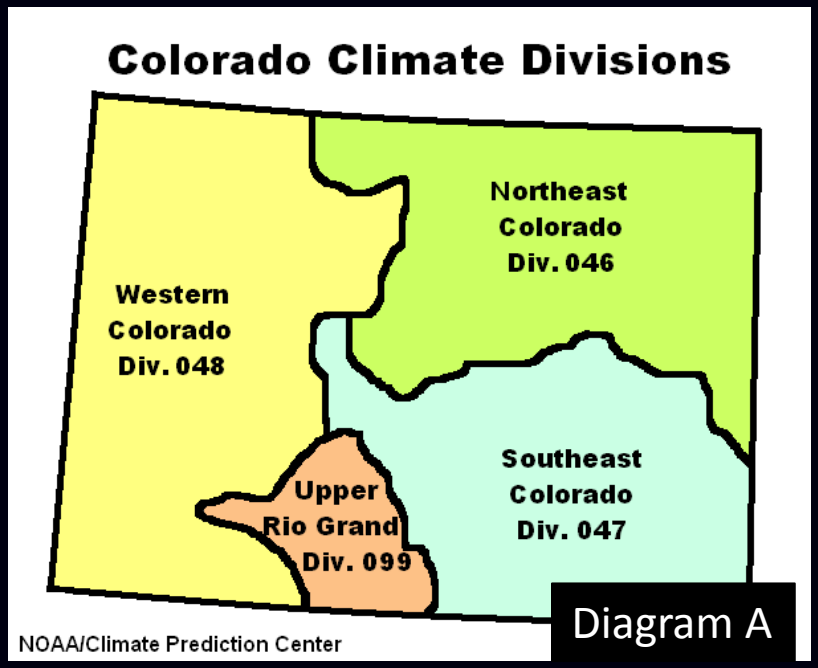


Diagram A: Colorado is sub-divided into four climate divisions. Climate divisions 046, 047 and 099 are located east of the Continental Divide.

NOAA's Climate Prediction Center (CPC) has produced historical distributions of 3-month temperature and precipitation associated with three different ENSO categories – El Niño, La Niña and neutral (non-ENSO) events – for each of climate division.

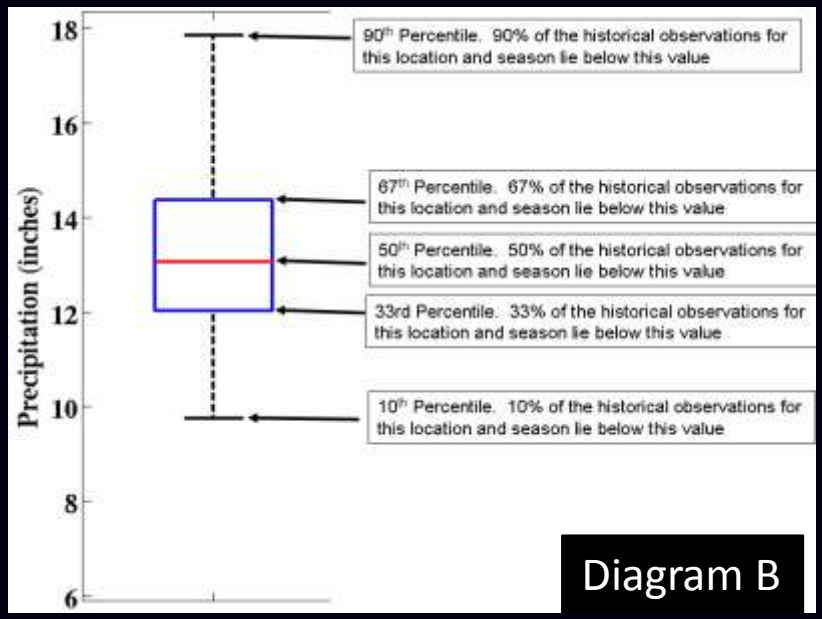
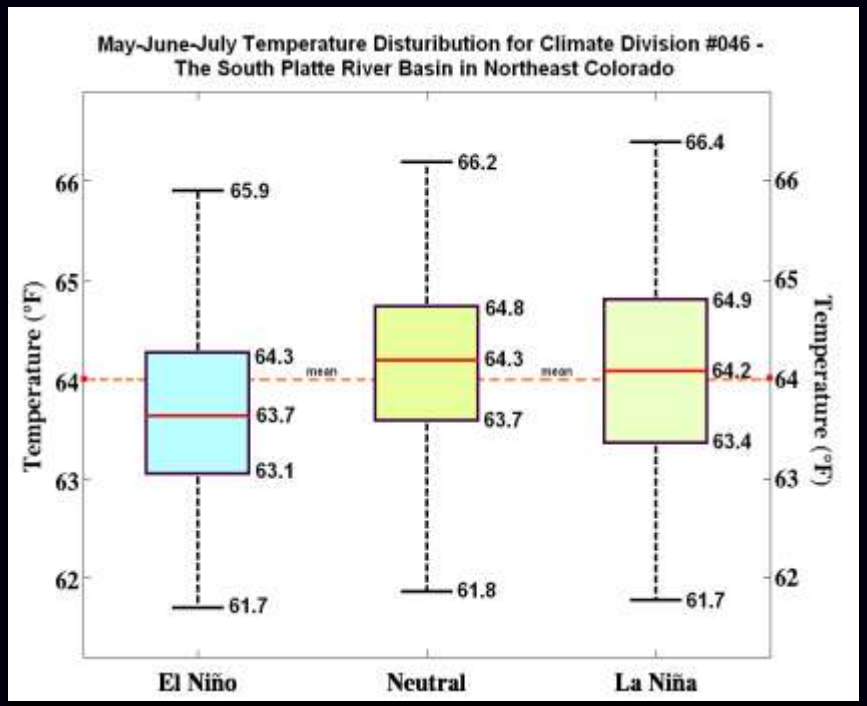
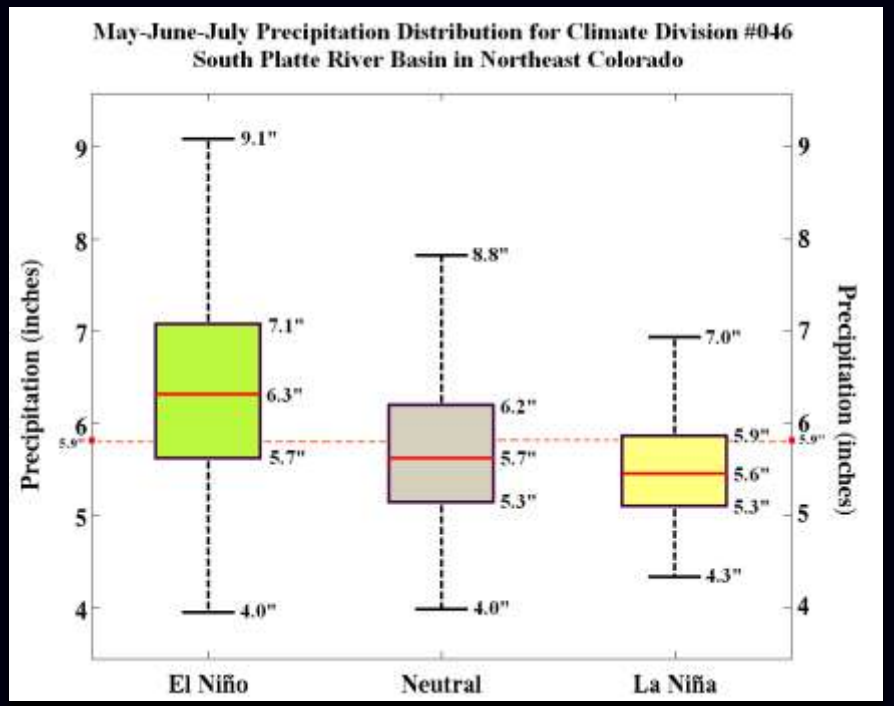


Diagram B: These historical temperature and precipitation distributions can be viewed using an ENSO box and whisker analysis plot (explanation to the left).

The red line inside the ENSO box represents the mean or 50th percentile of the data (temperature or precipitation) distribution. Approximately 34% of the total observations exist within the ENSO box, and the remaining observations (or 66%) outside of the box.

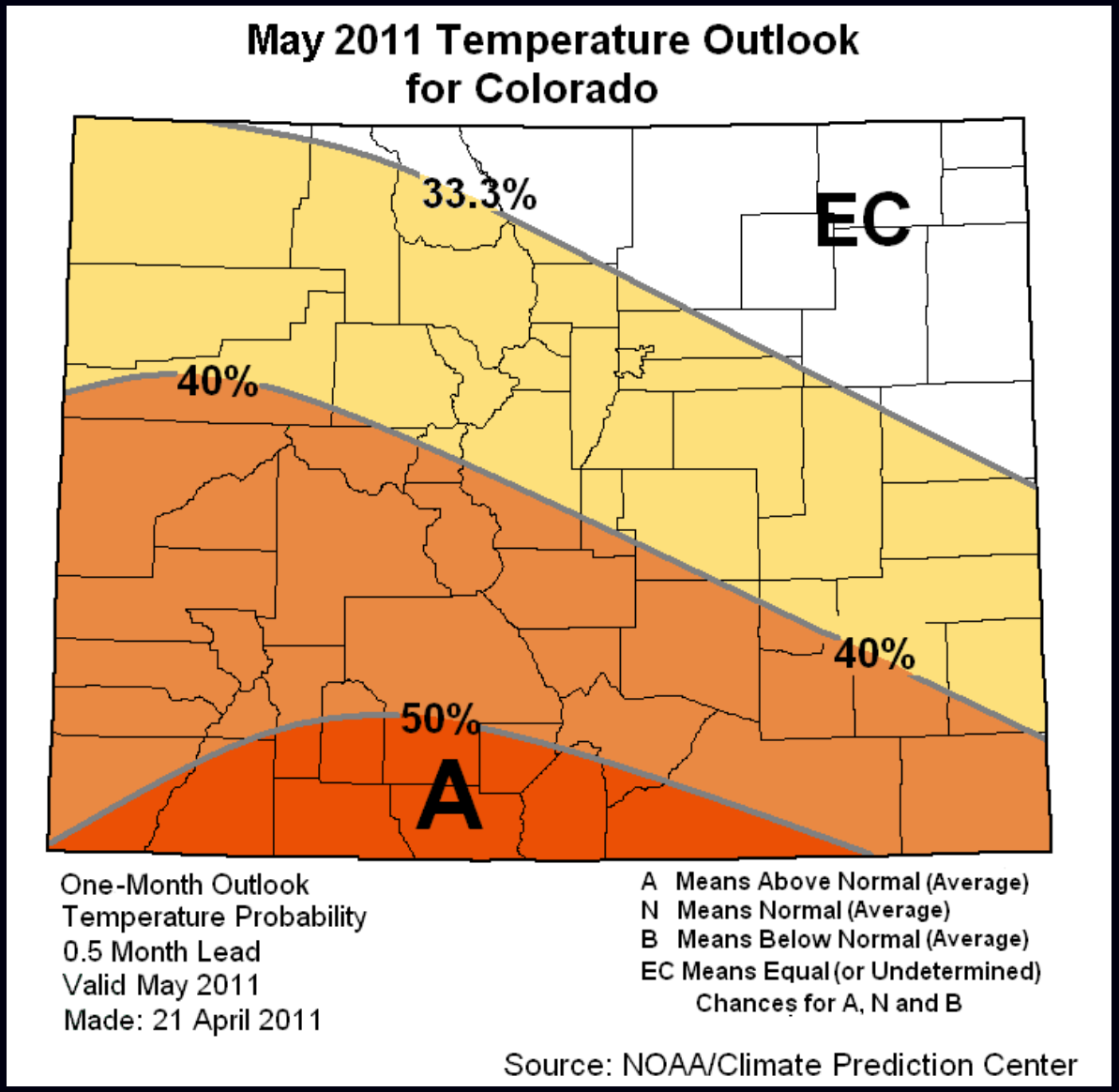
ENSO Box and Whisker Analysis Plots for Climate Division #046 – The South Platte River Basin in Northeast Colorado for the 3-Month Climate Season of April-May-June





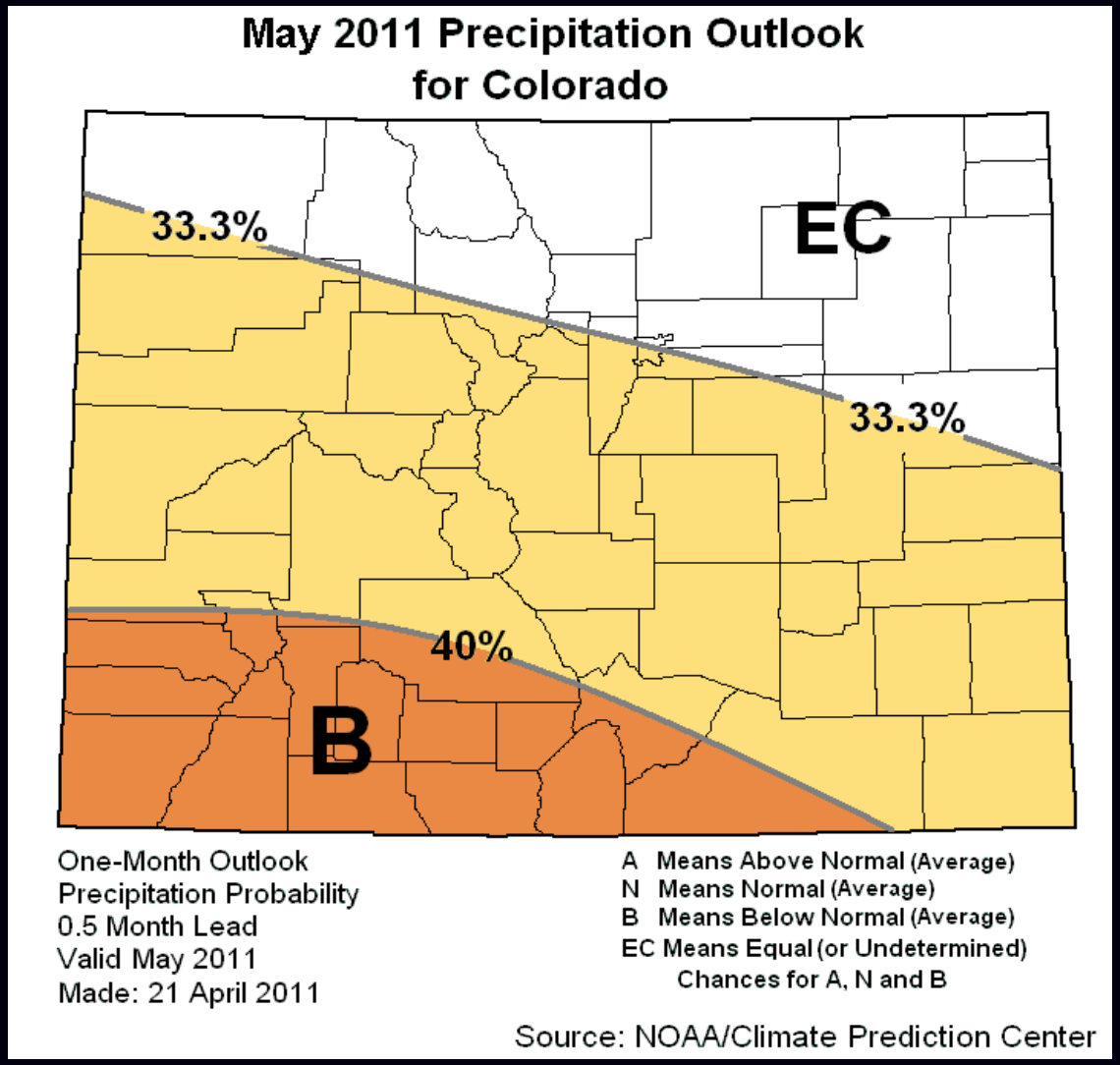
The whisker analysis plots in the above graphic indicate a slight bias towards cooler than average temperatures during El Niño, and near average temperatures during neutral (non-ENSO) and La Niña events. However, the total spread in average temperature is greater during La Ninas, a possible reflection of the drier than normal atmospheric conditions observed during these events.

The whisker analysis plots above clearly indicate greater than average precipitation during El Niño events and much more precipitation than what is normally observed during neutral/non-ENSO and La Niña conditions. The range in seasonal precipitation is less during La Niñas, possibly reflecting a reduced number of precipitation producing weather systems.



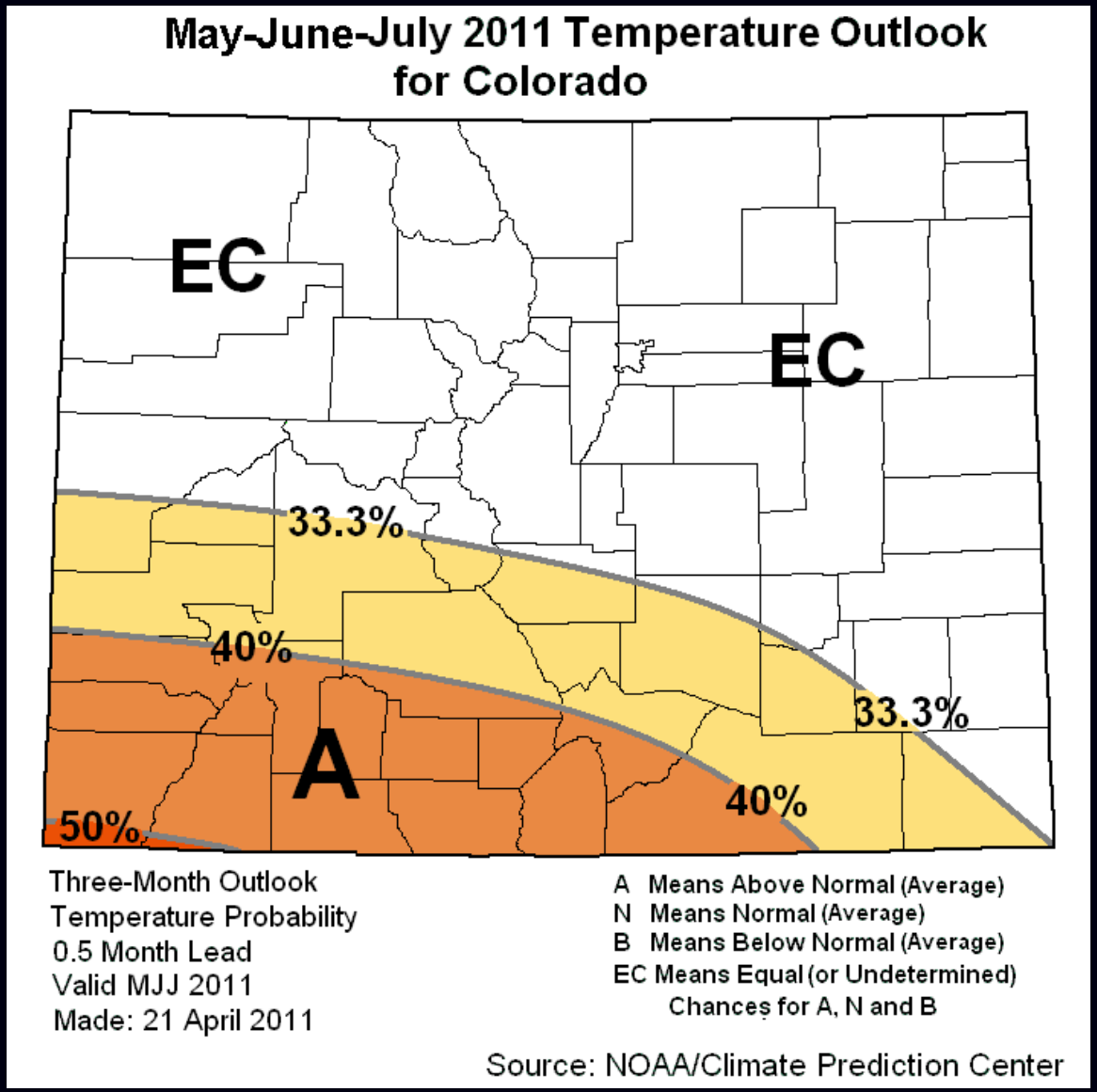
Temperature Outlook for May 2011

The outlook from the Climate Prediction Center (CPC) calls for a 40-50 percent chance that the temperatures will be above average across southern Colorado, with a 50-50 chance for warmer than average temperatures along the Colorado/New Mexico border. The temperature outlook is less uncertain across the northeast corner of the state as indicated by the EC designation.



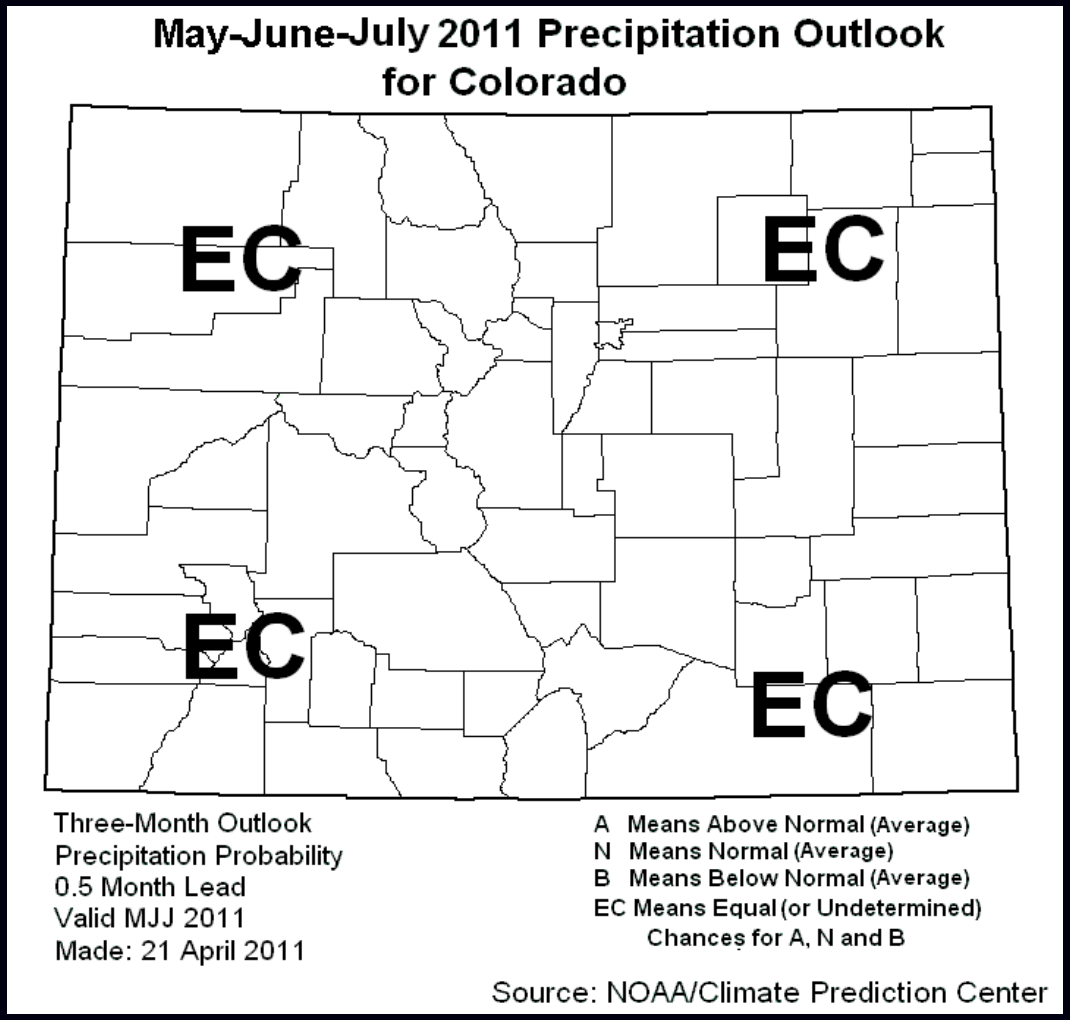
Precipitation Outlook for May 2011

The outlook from the CPC calls for at least a 40 percent chance of below average precipitation across the southern one-quarter of Colorado and a 33.3 to 40% chance of drier than normal conditions across the center half of the state. The precipitation outlook is less uncertain for the northeast quarter of Colorado.



Temperature Outlook for May, June and July 2011

The outlook from CPC calls for better than a 40% chance of above average temperature across the southwest one-quarter of Colorado and a 33.3 to 40% chance of above average temperature across the adjacent one-fourth of the state. The temperature outlook for the remainder of Colorado is less uncertain. CPC uses EC to indicate that there is an equal chance for above, below or near average temperature in this area.



The symbol EC is used by CPC to indicate an equal chance for above, below and near normal precipitation or temperature.

With the ENSO signal waning, CPC's skill to predict seasonal trends in temperature and precipitation also decreases to some degree.

Thus, the user may also interpret the EC label as an indicator of CPC's low confidence (a probability of less than 33.3%) in their outlook.

The precipitation outlook for May, June and July from CPC calls for an equal (or undeterminable) chance of above, below and near average precipitation across Colorado.